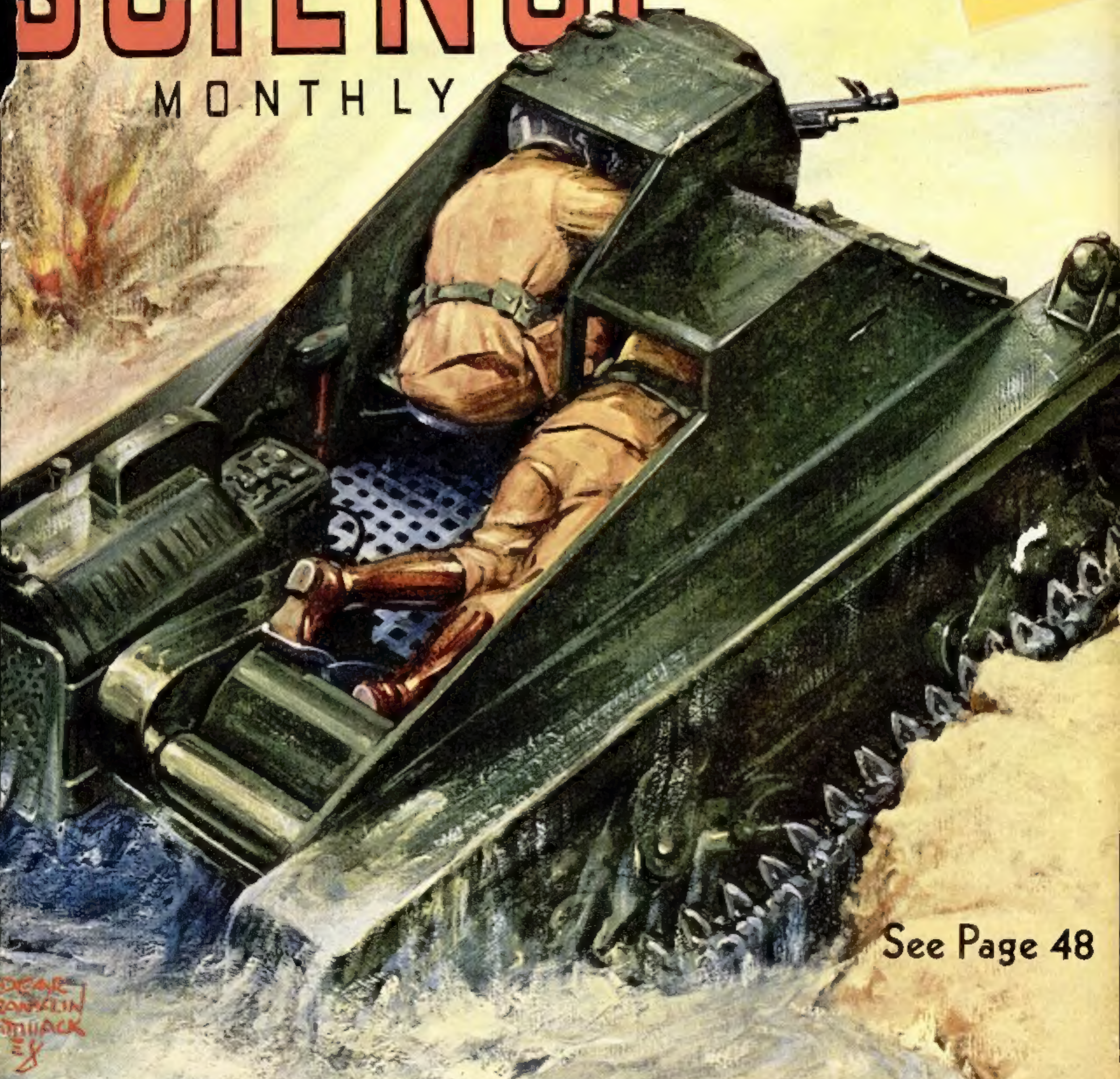


POPULAR SCIENCE

MONTHLY

JULY

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See Page 48

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 "NOT A DULL MOMENT!"
 "BEAUTIFUL COLOR!"
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NOT A DULL MOMENT

Another entertaining reel in this interesting series, this consists of a collection of subjects with not a dull moment, all done in Cinecolor. An unusual scene showing an operation performed to extract a swallowed safety pin is the highlight of the short which includes views of newest devices for safety aboard a liner, angora rabbit ranching, modern kitchen gadgets, and others.

BEAUTIFUL COLOR

One of the best of this very entertaining series. A fine diversity of oddities are presented, such as angora rabbit ranching; safety devices on a modern passenger liner; modern kitchen gadgets to make the life of the housewife a joy instead of a drudgery; varieties. But the ace presentation is the new X-ray camera that enables a surgeon to extract such things as an open safety pin from the lungs of a woman. Some very clever photography enables the audience to follow every step of this difficult operation. Finishes with a comedy skit concerning a patent hair restorer.

EXCEPTIONAL SCREEN FARE

Handsomely done in Cinecolor, this interesting subject again delivers exceptional screen fare. The items shown include angora rabbit breeding, new kitchen gadgets, a hair restorer and some remarkable garden-removal of a safety pin from a human lung with the aid of newly developed instruments. The sequence is very well done and the serious surgical drama of the occasion is apparent.

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Our Readers Say



And What Will Become of the Hot-Dog-Stand Industry?

ONE THING puzzled me in your article, "Highways of the Future." There was a diagram showing double-deck highways on which cars could travel at high speed. Now, this is very possible, but what about the sight-seers and tourists who want to drive along these highways and enjoy the countryside? If cars are developed to cruise along at a hundred miles an hour, what will become of the tourists that want to see something besides a ribbon of superhighway stretching out ahead of them?—E.J., Jr., Claremont, Calif.



Now We Must Produce a Race of Streamline Superhoboes

AT LAST, we have found the joint in the armor of the streamline train! I read recently about a hobo trying to steal a ride on one of the modern iron horses, and getting so tangled up in it that it took the engine crew, two policemen, and the conductor ten minutes to get him out unhurt. Obviously, the ancient and honorable order of hobs has not kept pace with the forward march of science. Perhaps the process of evolution will finally produce a streamline 'bo, prepared to cope with the new articulated cars. Meanwhile, designers of super-super railroad equipment should include some modernized version of the time-honored "blind baggage" in their designs.—E.P.E., Buffalo, N. Y.

Correction: Those Balloons Were Filled with Hot Air

THIS IS not to find fault, but to tell you of an amusing incident that has to do with your article on page 33 of the May issue, showing members of Alpha Eta Rho (international aviation fraternity) of the University of Southern California, in the annual meet with the Stanford flying club. In your description of the balloon-bursting contest at 2,500 feet, it was stated that these balloons were filled with gas. I'd like to correct that statement because I personally went into town and bought two dozen of them and returned to the field where the meet was to be held. Then the flying members of our fraternity had the audacity to ask me to blow the balloons up. Therefore, I state here and now that the balloons were not filled with gas, but good old lung power by myself, and then released high in the air. Trusting that this letter will amuse you, I remain a very old and loyal reader.—J. L. McC., Jr., Los Angeles, Calif.



A Fence To Keep Jaywalkers Out of the Hospital

SO New York City has solved the insoluble! Accomplished the impossible! In short, answered the jaywalking problem, by putting a picket fence down the middle of the street. And right in Times Square, "Crossroad of the World," at that! Think of it! Thousands of dollars, words, magazine and newspaper articles, speeches, advertising campaigns, and even books, have failed to correct a dangerous practice that even death and injury couldn't do away with—jaywalking. And now some fellow comes along and sticks an old-fashioned picket fence down the middle of the street—between intersections, which is where most of the jaywalking accidents occur. That fellow ought to be made a national hero. I'll bet he got the idea from the fences railroads put between the tracks in their stations. Unless I miss my guess, the idea will spread like wildfire. I wish I owned a fence company.—F.A.A., Newark, N.J.

Six Hundred Miles an Hour Is Going Some, He Admits

WHEN I read Lee Gehlbach's interesting article, "Ten Miles a Minute—Straight Down," it occurred to me that the speed attained in these dive tests must be about the highest that man has ever reached by any means of locomotion. Six hundred miles an hour is going some, and the fact that this speed is made in a vertical direction does not alter the case. We are accustomed to measuring the rate of travel from one place to another on the earth's surface, but as a matter of scientific record the earthward plunges of men like Gehlbach must represent the fastest speed at which human beings have ever traveled through space. It makes the muzzle velocity of the man who is shot from a cannon in the circus look like a snail in low gear.—A.D., San Francisco, Calif.



Here's a Vote for a Spectroscope

SEEING that everybody else is having his say about what he does and doesn't want, I decided I'd write and boost for my particular section of your most interesting and instructive magazine. I am rooting for chemistry and microscopy, mainly, though I read the magazine from cover to cover, enjoying every bit of it. I second the suggestion of R.A., Lincoln, Nebr. Why not combine chemistry and microscopy, and give us some simple analysis? I would like to see plans for an inexpensive spectroscope, and learn how to use it in chemical analysis. I get kind of hot under the gills

trying to detect sodium and potassium with a chunk of platinum wire and a spluttering old alcohol lamp.—G.I.M., Empress, Alberta.

She Likes "Whatnots" and She's Not Referring to Furniture

YOUR regular two-page display of new devices for lightening home chores is one of the most attractive features in your magazine to me. When I can get the magazine away from my husband and the boys, and when my daughter has finished with the "Readers Say," I retire to my comfortable chair and open my magazine to the two pages of intriguing what-nots. I want them all, as a rule, even the ones that I'd probably have no earthly use for. Using reasonable self-restraint, I've selected a number of them that have lightened my particular household burdens, and I can't help writing to say "Thanks" to P.S.M. for this one of its many good services in my home.—Mrs. K.D.V., Schenectady, N. Y.

ALL I NEED IS AN ENGINEER'S DEGREE



It's the Simple Things in P. S. M. that This Reader Likes

IT'S so many years ago that I don't remember just when it was that I began reading your magazine. It was before you used any colored ink in the make-up. I haven't kicked once and don't want to now, but aren't you giving the hobbyists a better break than the experimenters? We can't all own a woodworking shop or play with cameras. Give us more things that just require simple hand tools and a kitchen-sink workshop. Model airplanes and other small mechanical and electrical models are what most of us go in for, and they can be handled in a very small space by you and by us, too.—C.G., Chicago, Ill.

A War's a Good Thing If It's Somewhere Else

I AM far from being a militarist, but I've come to the conclusion that wars, so long as they are in another country, have at least one good effect. They certainly give the nut inventors and professional bellyachers something to think about. The inventors work night and day planning flying tanks and rolling battle-ships and the professional bellyachers can grumble to their hearts' content without meddling with affairs at home. Have you ever noticed how the (Continued on page 5)



(Continued from page 4)

chronic agitators leave old Uncle Sam alone when there's a spicy European brawl that gives them a chance to take sides? It's an ill wind that blows no one some good.—H. J., Detroit, Mich.

Suggests Antigerm Guns for Wartime Use

A RECENT issue of your magazine contains an account of a new "ray machine" which sterilizes operating rooms by destroying the germs with short-range rays. In the next war, we are told, whole cities will be wiped out by microbes dropped from the sky. Why couldn't these new machines be distributed about a city, ready to go into action killing off the released germs as they land? Working out such a scheme might save the lives of thousands of women and children if "germ bombing" becomes a reality.—R.H.M., Pasadena, Calif.



It Can Hit All Right, but Can It Run?

THAT monitorlike ferry for landing tanks ashore from battleships, depicted on the cover of your May issue, looks like an excellent offensive weapon, but it must have been designed by one of those superpatriots who think that their side is going to win every battle. It stands to reason that they won't; they never have. And it seems too bad to send costly tanks ashore that may not be able to get back on the battleships again in a hurry if necessary. You see, when a tank leaves its ferry for shore, all is well. But when it tries to get back on, the ferry's displacement will be increased so much that it will go aground in the shallow water. It will take more than underwater propellers to get it afloat again, unless it waits for the tide to come in, which it probably won't have time to do. Assuming its attack on the enemy has failed, what a swell target it will be! However, I suppose it will be manned by Marines, well known for their ability to "take it." I think that if this country gets into another war, I'll join the Army.—C.A.L., New Orleans, La.

He Wonders What's Become of Larry Brent

FIVE or six years ago, you featured a series of articles, "I Am Learning To Be a Flyer," by Larry Brent. I read this series and thought it was very interesting. Now, I often think of Brent and wonder how he is making out in aviation. I am sure many of your readers have the same thoughts. Perhaps you could get in touch with him and have him write a follow-up series on his experience, conditions in aviation at present, and so on. Whatever way you

CALL FOR
LARRY
BRENT



(Continued on page 6)

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Our Readers Say

(Continued from page 5)

decide to do it, I would be very pleased to learn what Brent is doing now, and whether his enthusiasm for flying has diminished.—A.L.B., Kingston, Mass.

Reader in "Suspense" Should Get the Hang of It Now

THAT reader who is in "suspense" over the motion of suspension bridges during storms might show spunk enough to investigate the matter before he gets all hot and bothered about it. From what he implies, you'd think that the bridges whipped back and forth like wheat growing in a field. Of course, if they did, cars and pedestrians couldn't cross during storms. But let R.P.S. recall the speed of the short pendulum under that small clock that used to stand on his grandparents' mantelpiece. Pretty fast? All right. Then let him remember the long pendulum on the grandfather's clock by the stairs. Pretty slow swing, by comparison? Now let him apply his common sense and visualize the rate of the swing of a suspension bridge whose catenaries—main suspension cables—dip down 150 feet or more. If he's got any imagination, he'll see that the bridge pavement probably swings back and forth so slowly that he wouldn't be able to notice it at all, particularly if there were a violent storm raging to give him other things to think about. As for pedestrians, they should know enough to stay in out of the rain, anyhow.—M.R.F., Oakland, Calif.

Too Bad Pythagoras Beat Him to It

YOUR correspondent in the June issue hit it right that it takes just six pennies to surround another penny; no more, no less. I also want to say that I believe I have made a discovery in mathematics. It is that the hypotenuse of a right-angle isosceles triangle—one half a square—is always 1.414 (probably 1.41421) times the side of the triangle, no matter what the size. Am hoping this will be of interest to your readers.—H. N., Lodi, N. J.

YOU DISCOVERED IT?



You Shouldn't Have To Read This Twice

AFTER reading the letter by W.C.C., of Delaware, Ohio, on the topic of reading, I find that I have a hair to split. A psychological study reveals that usually there is no definite pause at the end of a sentence unless that happens to be the location of one of the natural fixation points. An average reader will have three or four fixation points to a line. These are definite points where the eyes come to a brief halt, but there is no basis for the assumption that the eyes stop at the end of each sentence. Another point. The average reader does not remember individual words and fail to get the meaning of the subject matter. He will probably get the meaning of the matter,

(Continued on page 7)

(Continued from page 6)

but remember very few words. Lastly, W.C.C. says that the purpose of reading is to comprehend, not to get through in a hurry. This is true, but rapid reading is conducive to good comprehension.—R.S.L., Northfield, Minn.

His Own Problem Gave Us Something of a Twinge

PLEASE put an end to those age problems. They are a pain in the neck! Here's a *real* problem which I offer as a challenge to your readers. It's a tough one, and will probably knock the overconfidence of a few of the math sharks for a loop! In the diagram, the circle with center B rolls along the line MN. The initial point on the line is A and on the circle is A'. When the circle has rolled until A, B, and A' are in a straight line for the first time after the circle starts rolling, what is the size of the angle A'AN?—W.C.S., Cincinnati, Ohio.



This Is a Little De-tail the Inventor Overlooked

THAT refreshment table with a built-in electric fan is fine, but my pet pooch and inquisitive cat would have their noses and tails in the fan blades in just about two shakes!—P.D., Troy, N. Y.

He'll Go On Making Rivets from His Old Film Spools

C.W.C., of Rochester, N.Y., makes some very sarcastic remarks concerning my letter about using the No. 127 film-spool ends for washers and the aluminum centers for soft rivets. He does not have the practical knowledge of a craftsman to know that these washers are for special purposes. They would be hard to buy in that diameter. I wonder how long he thinks it takes to remove the ends from a few spools. Also, I would like to say that time is worth much more than six thousandths of a cent an hour here in Maine, as he states. Now, I do not live so far back in the woods that I have to buy washers by the bag from a mail-order house. I buy the ordinary, garden-variety washers and rivets from a well-stocked hardware store in Bangor, and I buy them by the pound. Well, "where ignorance is bliss, 'tis folly to be wise."—H.S.M., Bangor, Me.

Here's That Man Back Again, Asking for a Puzzle Page

YOUR recent article on spies and war codes interested me—not because I am fascinated by espionage stories, but because there is nothing that I like better than a nice, juicy cryptogram. Which, by the way, brings up the subject of an old, old plea: How about a page, or at least a half page, of good old-fashioned puzzles each month? If tricky brain teasers aren't "popular" science, I'd like to know what is.—R.T.P., Greeneville, Tenn.

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WHEN I began home study, I did not have a home. This was five years ago. I was forty-five then, and about as down and out and discouraged as a man could get and still wish to live.

In the worst of the depression, my wife died, and my three children married. I had failed in a small contracting business, lost my home and what money I had saved, and I was in debt. Rather than be a burden on any of the children, who could just get along, I packed a bed roll, a few clothes, and, telling my son that I had a job in Arizona, I started out on a tramp looking for work. I did not know or care where I was going. I landed, along with a lot of men who had never tried to bum a living, in a Government transient camp at Yuma, Ariz. I was pretty hungry when I applied. There, I was just one of 700 discouraged men who had failed to make a living. We slept in tents inside a high barbed-wire fence, in a fifteen-acre plot in the hot and sandy desert. The Government, at that time, was feeding the transients on a basis of twenty-one cents a day. I was glad to get even that kind of grub.

We got a dollar a week, tobacco, and clothes, and worked six hours a day. There was plenty of work in camp. It seemed good to have tools in my hands again, but of course I was anxious to get out.

I was thumbing an old magazine, one hot afternoon, when I came on an advertisement for the _____ School. It interested me because I had always wanted to write, and they offered a free test. I begged a stamp of the director of the camp and answered the advertisement. I passed the test and was accepted as a student. The director was interested when I told him what I was doing. He inquired about my former work, and asked if I had ever done any writing. I told him that I had not. Furthermore, I had used my education so little that I found it hard to write even a letter. But he must have been impressed by my earnestness, for, when the carpenter foreman quit, I got his job. This paid three dollars a week. I could now take the course, which cost only a little more than that a month.

I studied this course for six months. I never enjoyed anything so much in my life. Every man in the school seemed to be personally interested in what I was doing. I was given the use of a typewriter in the labor office, and I spent every moment of my spare time in learning to type and in working on my course.

In three months I was placed on the

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Secrets of Success

staff of the camp as assistant labor superintendent. At the end of six months I was superintendent, at a salary of \$100 a month. These promotions came only because the director knew I was really trying to do something.

The Government closed the camp, at this point. I was out, with no job in sight. But I had saved a little money, and the _____ School had encouraged me. So I rented a small room, a few cooking utensils, and a typewriter, and sat down to write something that would sell. I studied several magazines first. Then I wrote two stories, and, wonder of wonders, I sold them both. I cried when I got the first check. I wrote the _____ School a letter that was incoherent with pure joy.

I wish I could say that I sold more stories right away. I did not. But I did have enough money to move back to the town where my children lived. My course had given me something more precious than money—confidence. I work at the carpenter trade when I can get work. The rest of the time I spend very pleasantly with a small portable and a very large ambition.

I spend two days a week learning to write fiction, good fiction, and the rest pounding out articles, "how-to-do-it" stuff, and even poetry for a Coast columnist. These things I can sell. I averaged fifty dollars a month last year.

Not much of a success story, you say? Well, I don't know. I'm part of my family again. The children are proud of me. The grandchildren are wonderful. I can find my name on short articles in half a dozen magazines in the local library. I'm having fun. I'm learning to do a job that cannot be taken away from me. Sooner or later, I'll hit the big markets.

Best of all, I can see from my room the railroad tracks. Occasionally, men with bed rolls wander along them, going nowhere. But for that course in writing, I might be one of them.—G. E. M., Fullerton, Calif.

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ONE EVENING, I saw the _____ Schools display in a store window. I stepped in to inquire about their method of teaching. After talking to their representative, I enrolled for the mechanical-drawing course the very same evening. That was in November 1913. I liked the course so well and was so very interested in it that in June 1914 I signed up for the entire mechanical-engineering course. After completing all my drawings in this course, I also enrolled for the structural-engineering course. In March 1915, with the help of my drawings, I got a job in the machine shop of the _____ Co. I was soon transferred to their drafting room where I stayed until the country entered the World War, and in September 1917 I joined the Army. I had just completed



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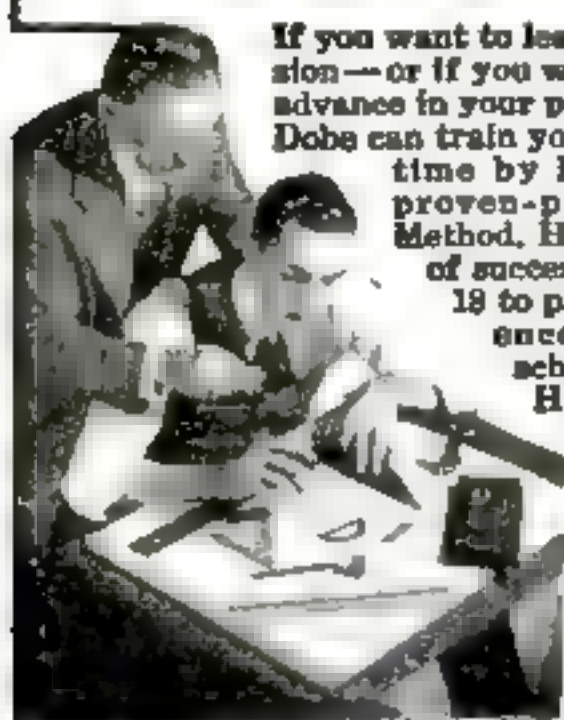
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and sent in my final-examination papers for the mechanical-engineering course the week before I left for the Army, so I received my diploma while in camp. Here, too, I think my course helped me to be promoted in just nine months from a private to the highest rank of a noncommissioned officer of the branch, with almost double my former pay. After my release from the Army in April 1919, I went back to the _____ Co. as a draftsman.

To gain a wider experience, in February 1925 I secured employment with the _____ Co. as a checker. From there, in November 1926, I went back to the _____ Co. as a designer and layout man. I completed my structural-engineering course and received my diploma in 1928.

I am now employed by the _____ Co. as an engineering draftsman, doing both mechanical and structural work at a much better salary than I ever dreamed of getting at the time I enrolled for the home-study course.

I am glad to say that the _____ Schools helped me a great deal. What it did for me, I think, it could do for others.—F. M., Cleveland, Ohio.

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She would sit by the living-room table during the evening and write. Sometimes she would look up, answer some child's question, and go on again in spite of a screeching radio and a multitude of other noises. It was my admiration of her and what she was doing that first started me on the story-writing endeavor. With her I enrolled in the _____ School.

Some months later, I put my boy in boarding school and moved to another location where I was truly alone. It was

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Secrets of Success

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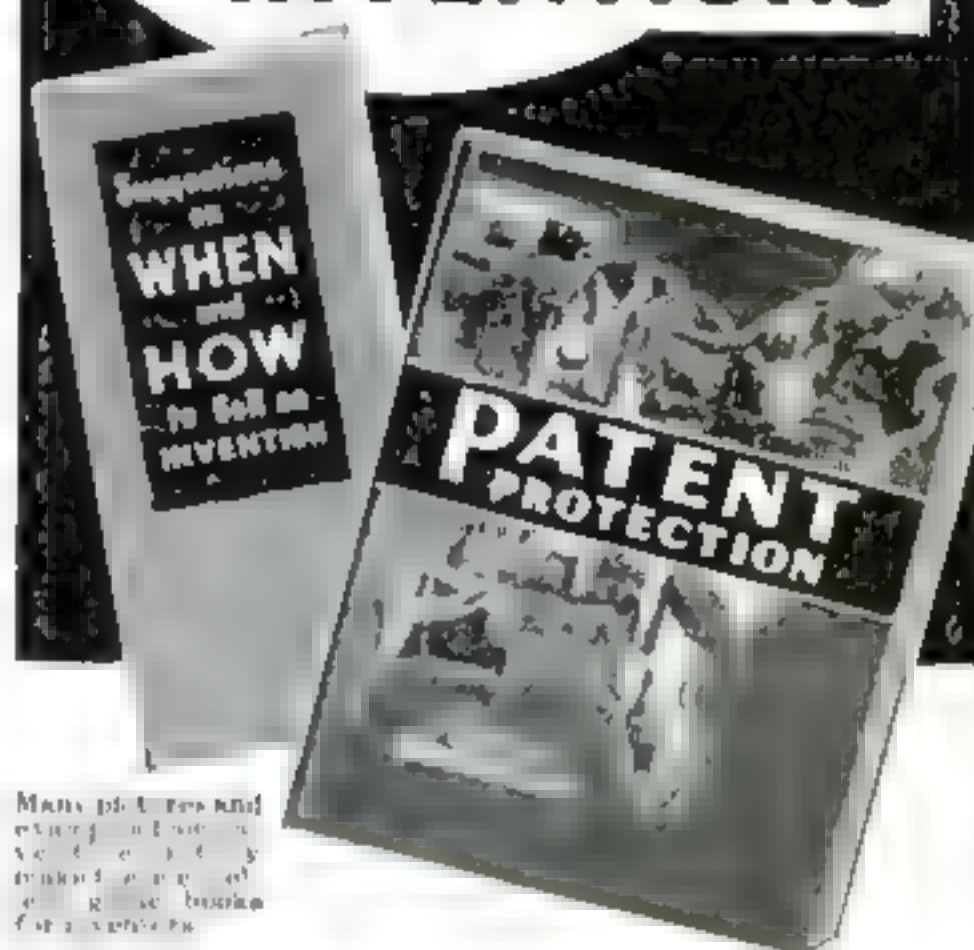
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Handy Aids for Home Mechanics

Periscope for Door Identifies Callers

ATTACHED to the front or back door, an ingenious periscope permits the housewife to see who is outside without having to open the door. The viewing device is fastened through a single small hole drilled in the top of the door, exposing on the outside only an inconspicuous disk that picks up the image of the caller and reflects it through the periscope stem to a three-inch, globe-shaped glass viewing screen on the inside. The latter is fitted with a magnifying glass which makes it easy to identify the person who is calling.



By looking into the fixture at the left, the housewife can see callers without opening the door



Wire-fencing tool in use for pulling out a staple

Handy Tool Speeds Wire-Fencing Work

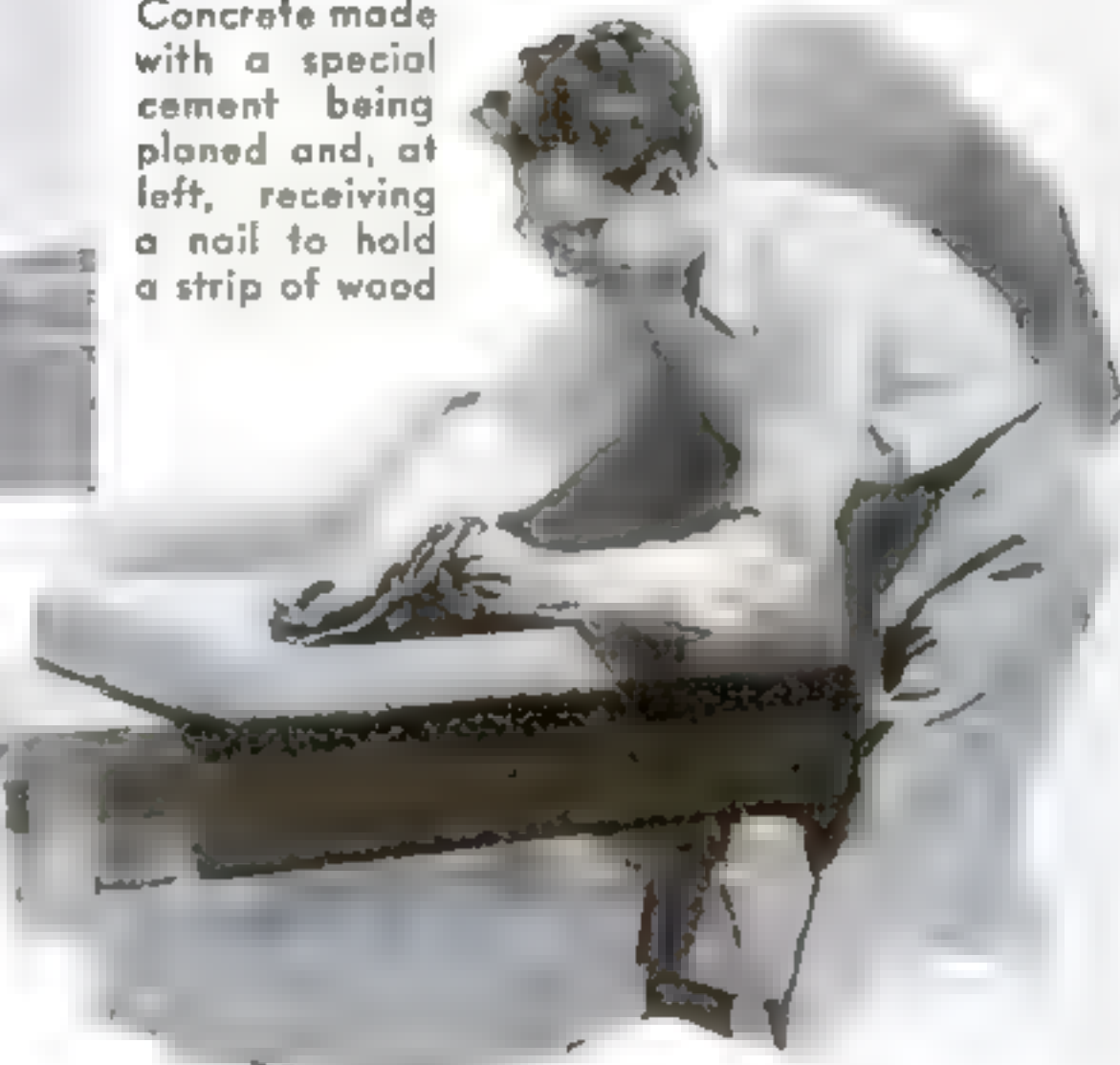
ERECTION or maintenance work on wire fences is made easier by the new tool shown at the left. One set of jaws in the tool head grips the wire tightly for stretching, while another is useful for making twisted connections. The head of the tool also provides a convenient hammer and a sharp prong for loosening deeply buried staples.

Concrete Slabs Can Be Nailed and Planed



Concrete made with a special cement being planed and, at left, receiving a nail to hold a strip of wood

A CEMENT mix now available produces a concrete slab to which wood and other materials can be nailed. Light in weight, the nailable slab is designed particularly for use in roofing, as it forms a suitable base to which slate, tile, copper, or other roofing materials may be nailed. The slabs can also be planed.



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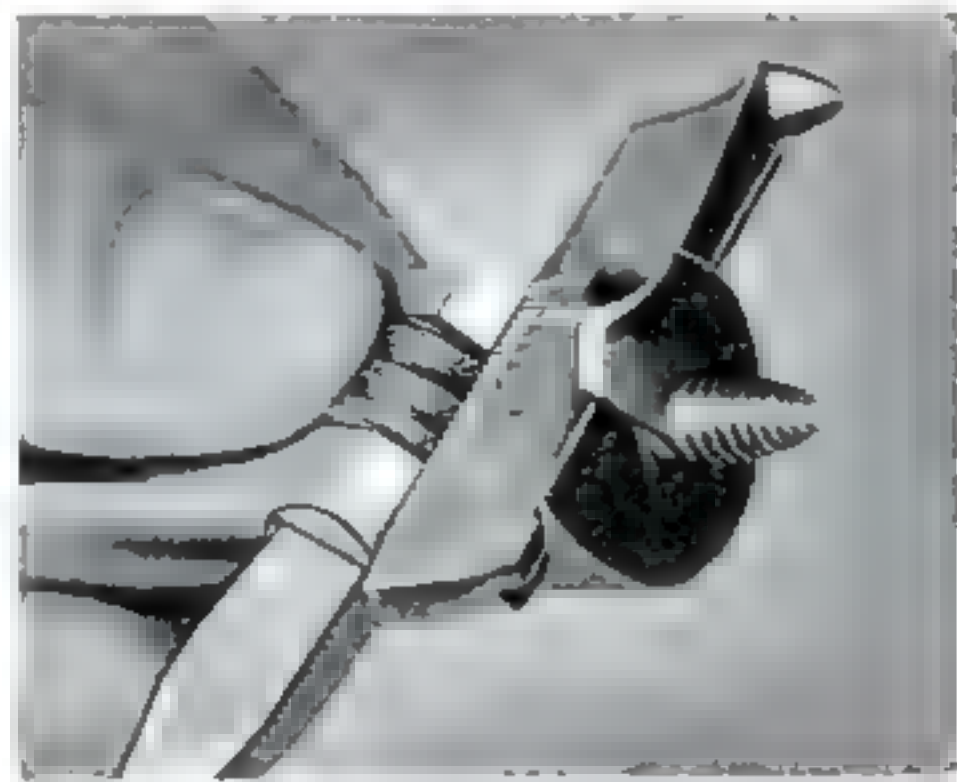
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Built-in Micrometer Sets Expansion Bit

AN EXPANSION BIT for boring large holes in wood, recently placed on the market, has a built-in micrometer unit for adjusting the cutting size quickly and accurately. As pictured in the illustration reproduced above, the cutting arm is moved closer to or farther from the center screw by rotating a small wheel with the thumb. When the cutter has been set to the exact size desired, as indicated by the scale on the cutting arm, it can be locked in place with a screw driver. The expansion bit will bore holes up to three inches in diameter.

Questions FROM HOME OWNERS

Q.—I AM planning to line the sides of a board-sheeted well with concrete to keep the surface water from seeping in and contaminating the good water. However, I have been told that if I do this the water and chemicals in the cement will make the well water unfit for use. Is this true?—F.F., Stemmers Run, Md.

A.—CONCRETE is recommended for well linings by very good authorities, including the U.S. Department of Agriculture, and the trouble you suggest should not arise. However, if you desire to play safe, you could have a sample of the well water analyzed by a chemist after the concrete lining has been completed.

What Is a Board Foot?

R.H.R., RICHMOND, VA. A board foot, the unit by which lumber is generally sold, is one square foot one inch thick. To find the number of board feet, multiply the length in feet by the thickness and width in inches and then divide the product by twelve.

Finish for Peeled Logs

B.J., ERIE, PA. Boiled linseed oil, applied warm, is one of the best finishes for the peeled logs of a summer cabin. Give the logs three coats, allowing a couple of weeks between coats. The first coat should contain twenty percent turpentine, the second ten percent, and the third should be used without any thinner.

Where Do You Go From Here?

You're like a million other men today—you're facing a big question.

The late depression turned business topsy-turvy and now the rebuilding period stares you in the face.

Where you are "going from here" is a question you want answered right if you expect to get ahead—progress—grow instead of standing still.

Are the things that are happening today going to help or hinder you—what will they mean in your pay check? Where will they put you five—ten—twenty years from now?

How can you take full advantage of this time—this period of opportunity? We believe you will find the answer here—a suggestion—a recommendation the soundness of which can be proven to you as it has been to thousands of other men.

The road to success remains unchanged, but, bear this in mind, what it takes to win is radically different!

No employer today would dare risk an important post in the hands of a man who had not learned the lesson of 1929. Why should he, when right at this moment he can pick and choose and get almost any man he wants at his own price?

Business organizations are rebuilding—reorganizing for the new conditions. Before it is over, every man and every method will be judged in the cold light of reason and experience—then dropped, remade or retained. This spells real opportunity for the man who can meet the test—but heaven help the man who still tries to meet today's problems from yesterday's standpoint! Out of the multitude still jobless there are sure to be many frantically eager to prove him wrong and take his place.

Some Men Have Found the Answer

Seeing these danger signs, many aggressive men and women are quietly training in spare time—are wisely building themselves for more efficient service to their employers.

You naturally ask, "Has your training helped men withstand conditions of the last few years?"

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This is a serious study of the possibilities and opportunities in that field. It is certain to contain an answer to vital questions bothering you today about your own work and earning power.

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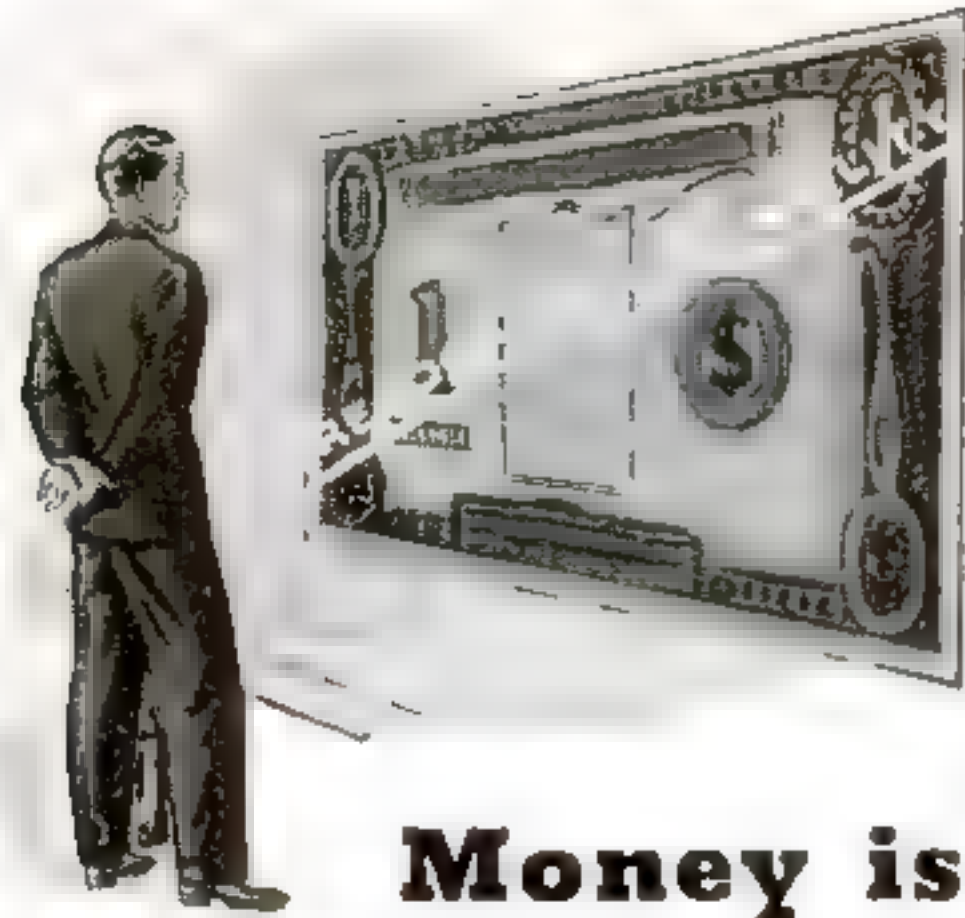


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Sea captain made from Kit No. 7

Pictured above are the materials contained in our copycraft whittling kit (No. 10, price \$1.50), which we recommend for beginners. It contains a master model of "Hobo Hank" so that all you have to do is to copy it cut by cut on the stenciled pine block. We also have kits for whittling a sea captain (No. 7, \$1.50) and six different Scotties (No. 8, \$1.00).

Complete instructions are included.

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| M. Aircraft carrier <i>Saratoga</i> , 18-in. | \$1.00 |
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| R. U. S. cruiser <i>Tuscaloosa</i> , 11 1/4-in. | 1.00 |
| U. <i>Hispaniola</i> , the ship in "Treasure Island," 7-in. | .50 |
| Z. H.M.S. <i>Bounty</i> , 11 1/4-in. | 1.50 |

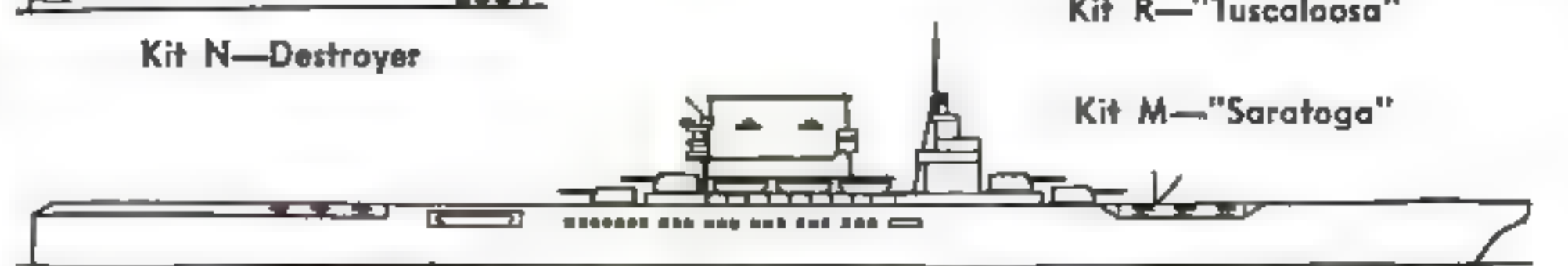
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Kit N—Destroyer



Kit R—"Tuscaloosa"



Kit M—"Saratoga"

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| 2M. Ocean freighter, 14-in. | 1.50 |
| 3M. Yacht <i>Nourmahal</i> , 8 1/4-in. | 1.00 |
| 4M. Oil tanker, 14-in. | 1.50 |
| 5M. Liner <i>President Lincoln</i> , 14 1/4-in. | 1.50 |

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| H. Cruiser U.S.S. <i>Indianapolis</i> , 12-in. | 1.50 |
| J. Clipper ship <i>Sea Witch</i> , 13-in. | 1.50 |

STANDARD SHIP MODEL KITS

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| A. Whaling ship <i>Wanderer</i> , 20 1/4-in. hull, 27 1/2 in. over all. | 7.40* |
| D. Spanish galleon, 24-in. hull, 30 in. over all. | 6.95* |
| E. Battleship U.S.S. <i>Texas</i> , 3-ft. | 7.45* |
| G. Elizabethan galleon <i>Revenge</i> , 25-in. hull, 28 in. over all. | 7.25* |
| L. Farragut's flagship <i>Hartford</i> , steam-and-sail sloop-of-war, 33 1/2-in. hull, 41 in. over all. | 8.45* |
| Q. Privateer <i>Swallow</i> , 12 1/2-in. hull, 20 in. over all. | 4.95† |
| V. Clipper <i>Sovereign of the Seas</i> , 20 1/2-in. hull, 26 in. over all. | 4.95† |



Kit Y—a picturesque trading schooner

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| Y. Trading schooner, 17 1/2-in. hull, 22 1/4 in. over all. | 4.90† |
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| 10S. Confederate raider <i>Alabama</i> ; steam sloop, bark rigged; 3/32-in. scale; 21 1/2-in. hull, 28 in. over all. | 8.20* |

(Continued on page 19)

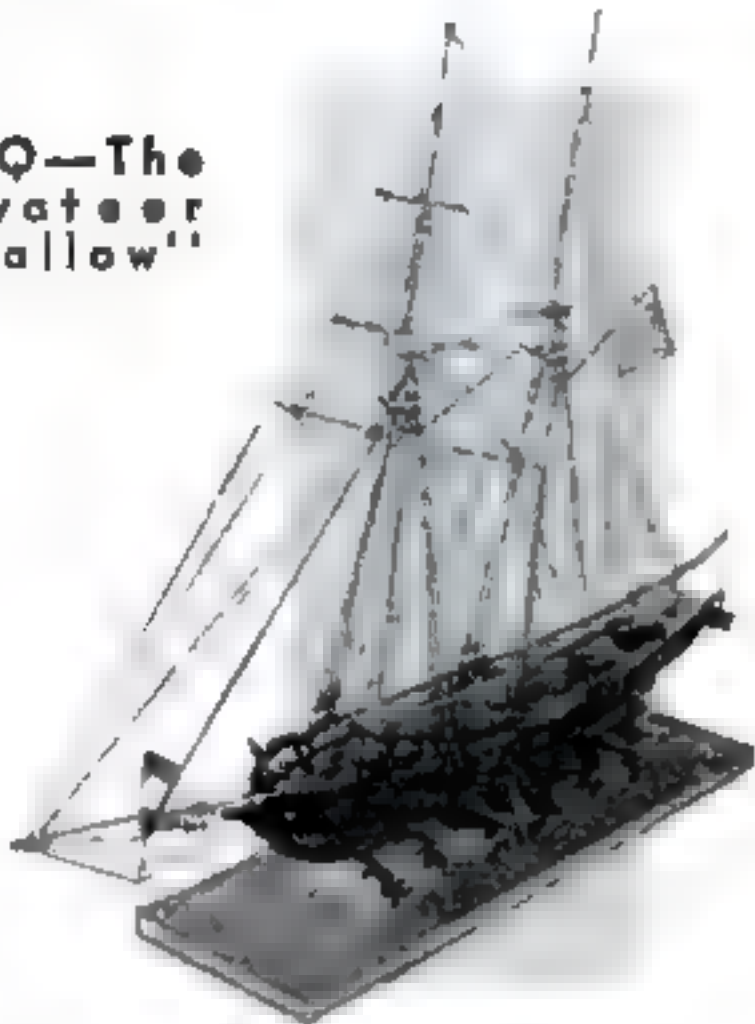
Kits for Hobbyists

(Continued from page 18)

MODEL RAILWAY KITS

- 1L. Model locomotive, Hudson type HO gauge. Kit contains all the necessary sheet brass, brass tubes, rods, wire, springs, fiber, screws, boiler head, ladder strip, six driving wheels, and ten pairs of wheels. Locomotive and tender are 14 in. long 9.95*
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Kit Q—The privateer "Swallow"



- 3L. Track kit. Contains running rail, third rail, cardboard ties, spikes, etc. for making 25 ft. of HO track 4.00*
- 4L. Deluxe track kit. Same as 3L except that kit contains third-rail chairs, which eliminate much of the soldering..... 6.95*

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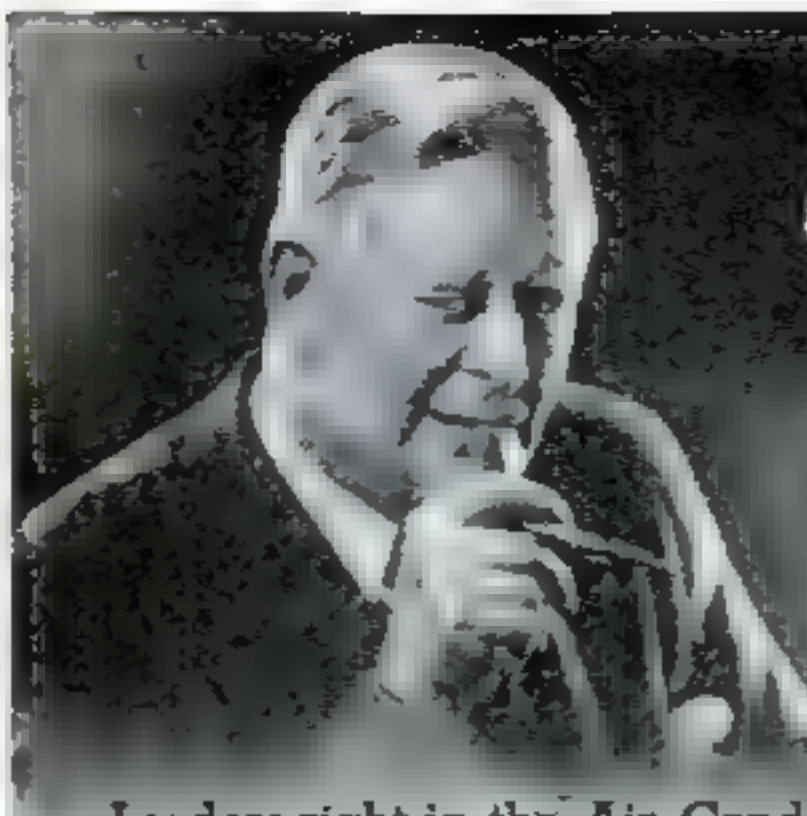
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RAYMOND J. BROWN, *Editor*



By
**WALTER
E.
BURTON**

Rubber is much in evidence on the beach, with bathing suits, shoes, and other accessories made of it. At the upper right is a scene in a factory making rubber gloves



Stretching THE USES OF RUBBER

WHEN the owner of a large poultry farm discovered the need for a mechanical brooder to mother his new-born chicks, a well-known rubber manufacturer devised an ingenious rubber "hen." When engineers were searching for a corrosionproof coating that would stretch, laboratory experts filled the bill with a novel rubber paint. In the United States, one rubber company alone has solved more than 32,000 different problems in over 1,000 distinct lines.

New uses for rubber run to a staggering total and range from rubber fly paper to elastic ink. Today rubber is one of the most versatile of industrial materials, and revolutionary and often surprising applications are constantly being discovered in the research laboratories of the nation.

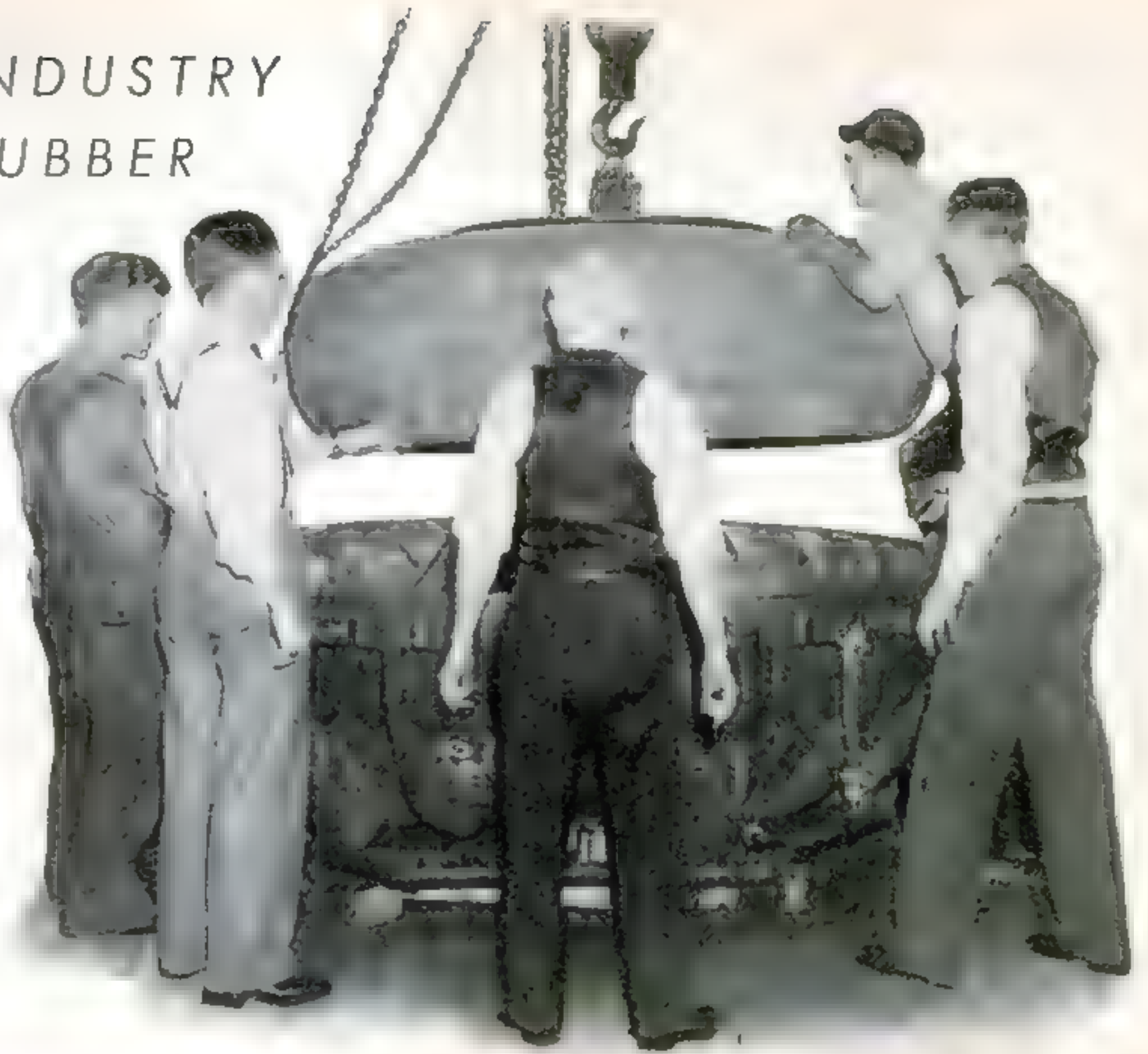
A short time ago, for example, chemists concocted a brand-new rubber material, a thin layer of which performed a task of endurance that proved too much for rugged oak planking six times as thick.

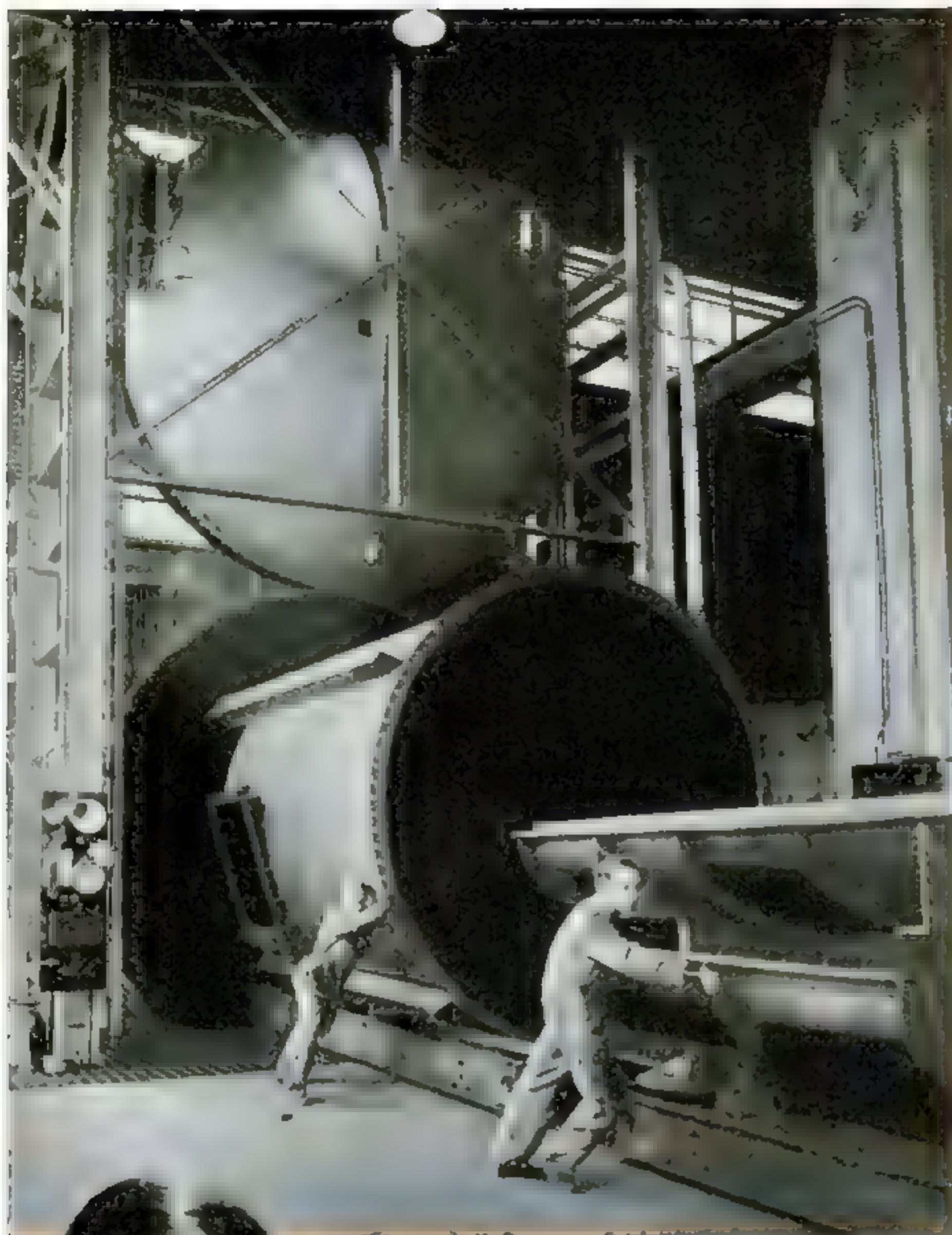
An Ohio horse owner had built a special van for transporting his animals around the country. Everything about the vehicle satisfied him except the flooring. He found that the restless hoofs of the horses soon splintered the three-inch oak boards. He tried matting, but this too was quickly torn to shreds. Finally, he took his troubles to the rubber experts. (Turn to page 22)

Almost Anything from Fly Paper to Horseshoes Can Be Made of This Versatile Material

WHEELS OF INDUSTRY ROLL ON RUBBER

Trucks hauling earth or ore in construction and strip-mining work now roll on mammoth rubber tires weighing 540 pounds each and capable of supporting a weight of 15,740 pounds to a casing. Four of them on one axle will support thirty tons. In the picture at the right, one of these heavy-duty giants is being placed in a mold at the factory to be cured.





A steel tank being removed from a mammoth vulcanizing unit in which it was given an acid-resisting lining for industrial use



The milkman's horse doesn't disturb your rest if he wears rubber shoes like the one shown above, at top, in comparison with the conventional sleep-shattering iron kind

Digging into their bag of tricks, they provided an answer in the form of an armorlike rubber similar to that used for lining gravel chutes and sand pipes. Applied to the van floor, a sheet of this rubber only half an inch thick now withstands the chopping action of the horses' hoofs that splintered three-inch oak. And, while they were at it, rubber technicians suggested a sponge-rubber lining

for the van walls that prevents the horses from bruising themselves as the vehicle bumps along over rough roads.

Much of the present-day development in the science of rubber takes the form of chemical overhauling and remodeling. Not satisfied with the rubber molecule as it exists in its original state, rubber experts are constantly devising methods of changing its chemical properties by altering its structure.

One of the results of this type of re-



Hot water circulates through these rubber "glasses," used in treating eye ailments. Water flows through the tube at the rear

search is rubber ink. This is now used especially for applying lettering to automobile-tire inner tubes and other rubber articles, but experiments are under way to adapt this elastic fluid for printing on paper. Considerable progress has been made—enough for some authorities to express the belief that at least part of the 2,000,000 pounds of printing ink used in this country every year will soon be made of chemically altered rubber.

Already, the printing trades are making use of rubber plates, containing both type and engravings, for printing business forms, food wrappers, telephone directories, and even books. And experiments have been carried on with rubber as a filler for paper. Success in these tests may ultimately result in making it possible for you to write a real "rubber" check—rubber ink on rubber paper.

Deliberate molecule-juggling, with painstaking, carefully planned research in which hundreds of compounds are concocted and tested, generally precedes the discovery of a new rubber application. But occasionally, accidental or at least unexpected occurrences start a new line of research that results in opening up an entirely new field for rubber.

Not long ago, for instance, phonograph records made from a rubber compound were behaving like a bride's first cake, sticking to the molds in which they were pressed out so that a recorded swing tune might emerge with a "hot" break or even a whole chorus missing. Chemists familiar with the peculiarities of rubber tackled the problem and soon discovered that the dye used to color the records seemed to be the source of the trouble.

In the course of their experiments, technicians mixed up sample batches of a rubber compound that stuck like a leech to any container in which it was placed. No amount of prying could loosen it. This unexpected development soon became of much greater importance than the original record problem. Research into "sticky rubber" became the basis for a thriving business.

For this stickiness that annoyed record manufacturers resulted in a compound that can be securely "welded" to wood, metal, and practically any other kind of material. Linings of this rubber are now used for acid-pickling vats in steel mills, and for sewer pipes that carry off hot, corrosive wastes. About 400 railroad tank cars have recently been given this rubber lining. Fans and blowers covered with the adhesive compound remain unharmed by powerful acid fumes.

Sometimes rubber experts can combine two different kinds of rubber that are already in use to form a brand-new type for a specific purpose. This procedure solved a problem for the tree surgeon called in to doctor seven aged trees that were planted over a century ago by Thomas Jefferson on his famous estate at Monticello, Va. In his efforts to save these historic trees, all of which were dying of rot, the tree surgeon decided that rubber should be ideal for sealing cavities after decayed wood had been scraped away. Being flexible, rubber would give as the trees bent in the wind. Furthermore, he felt, rubber's softness would prevent damage to the tender cells of bark trying to cover the wound, while rubber's pliability would enable it to be modeled and then colored to simulate actual bark.

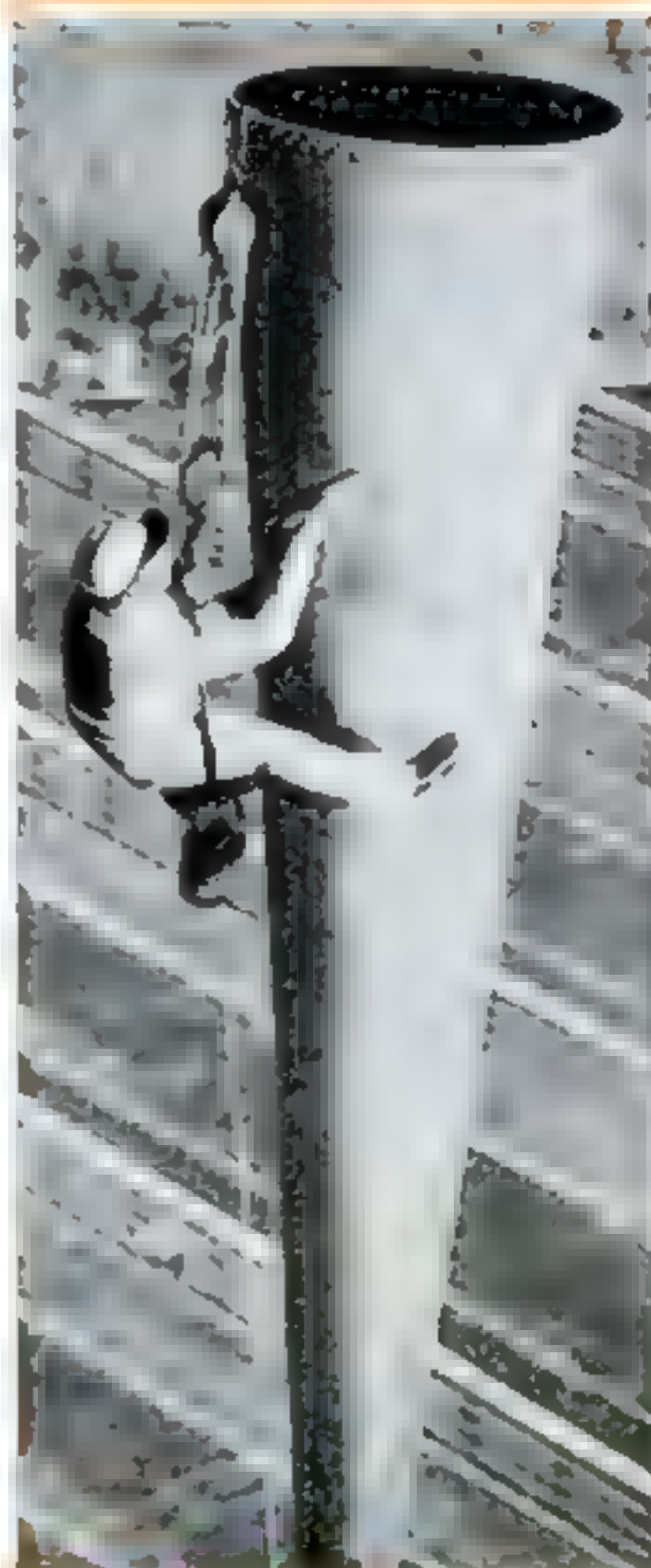
Rubber experts admitted that they did not have a compound that was suitable for the purpose, but decided that they

might combine a group of rubber materials to produce one that possessed all the required properties. There was a conveyor-belt formula that would resist air, sun, water, and changes in temperature. And there was an automobile window-channel rubber noted for its extremely long life. By combining the desirable qualities of these with other compounds, the experts worked out an effective filler. Rubber, extracted from a tree, would restore another tree. A hundred years from now, Jefferson's stately trees may still be standing—thanks to rubber.

Schemes for new uses pour into the research laboratories from all parts of the world. One company in Ohio receives about 150 ideas a week, although a great majority of these are impractical for one reason or another. And each weekly batch is



When this outfit appears at the seashore, the spectators become rubbernecks. At left, a workman is applying a coat of rubber paint to a smokestack to enable it to resist acid fumes and corrosion. The paint expands with the metal



Potato-grading machine fitted with disks of a special rubber compound that is immune to grit

bound to contain that perennial joker, the duck-foot glove.

This fantastic idea, which has been submitted literally hundreds of times, calls for a rubber glove with elastic webbing between the fingers. When worn by swimmers, its proponents say, the gloves would make the Australian crawl look like a sit-down strike, since they would permit the hands of the wearer to exert a tremendous pressure on the water at each stroke of his arms.

Rubber experts always politely reject this idea, partly because swimming gloves were invented fifty years ago, and partly because it would be difficult to think of anything more uncomfortable for the swimmer.

Outsiders, however, provide the initial impulse for most of the new developments worked out in the research laboratories. In many cases, the impetus comes from an engineer or manufacturer desiring to find a rubber compound he can (Continued on page 104)

ANYONE CAN FLY THIS



Crashproof Plane

The "foolproof" plane in flight. The engine is mounted back of the cabin and the pusher-type propeller revolves between the tail outriggers



He Never Had a Lesson!

HOW would you like to sit down at the controls of a plane and take off, without ever having had a lesson in flying? That is the experience which Andrew R. Boone describes for you in this vivid first-hand story. Read how it feels to fly a plane that is as easy to handle as your automobile—one that you can't crash or put out of flying control unless you try mighty hard.

SLIM PERRETT touched a button on the control column and swung the wheel over to me.

"There's the green light," he said, smoothly. "Pull her back, shove the throttle open, and take off."

I looked at Slim, an "is that all?" expression in my face. "Go ahead," he grinned.

I grasped the wheel firmly, drew it back against my chest, and pushed the round knob actuating the throttle.

Immediately we were rolling, the power of the 150-horsepower motor pushing us quickly into the ten-mile-an-hour wind. Keeping my eyes fixed on the concrete strip, I awaited the thrilling moment when we should leap into the air.

That moment never came. We had gone perhaps 300 feet when suddenly I realized we were off the ground and climbing. My only contributions to this take-off had been the opening of the throttle and sitting very still with the wheel held in the extreme climbing position.

I glanced at the air-speed meter. The needle hovered on the sixty mark.

"Got off at fifty miles an hour," Slim said. "Keep climbing to 1,000, then level off."

We were up 500 feet when our shadow crossed the south boundary of Union Air Terminal, the large air field at Burbank, Calif., where the airliners are serviced between runs across the nation. With the railroad tracks and power lines safely underneath our wings, I stole another look at the instrument panel. Air speed seventy miles an hour, climbing 1,000 feet a minute.

Fortunately for my peace of mind, the air was smooth. Yet the wings wobbled and the little ship's nose seemed to be veering right and left from a straight line. Slim quickly corrected me.

"Settle down," he urged. "You're over-controlling."

I made an effort to recall his instructions. "If you can drive an automobile," he had said, "you can fly this airplane." The ship to which he referred, and which I was none too skillfully piloting, is the little cabin Stearman-Hammond, developed as a manufacturer's answer to the Air Commerce Bureau's demand for a foolproof flying vehicle. I was trying to determine whether an inexperienced groundling, without benefit of prior instruction in airplane flight, really could take the ship off, fly it, and land without smashing the craft into a thousand pieces.

One does not ordinarily take off in an airplane with the stick or wheel held back. Not even in this plane. Slim had tricked me slightly, I discovered later, by winding the stabilizer to the completely nose-

heavy position. By thus counteracting to some extent the flippers' action, the plane will fly herself off any field, into the wind, cross-wind, or down-wind providing the breeze is not too stiff and there's plenty of room.

Consciously, as his earlier words raced through my mind, I endeavored to hold the wings level, turning the wheel right and left. This action corrected the wing position, but also changed the plane's direction. On this plane, the twin rudders are bolted tightly in place, like fixed vertical stabilizers. Turning the wheel moves the ailerons, each being arranged to be depressed at a sharper angle than the other is raised. This added drag causes the plane to change direction with each movement of the ailerons. Thus, pedals for steering have been eliminated. On the right side of the cabin, where I sat, there are no pedals. On the left are two—one for setting the wheel brakes, the other connected with the wing flaps, or air brakes.

Scarcely had we left the field, when Slim pointed to the altimeter. The needle had swung slightly past the 1,000-foot mark. It was then that he explained the stabilizer trick.

"Wind it back until the ship's in trim," he said.

With something of a mental effort, for fear I would nose the little ship down into a dive, I eased the throttle out and slowly returned the wheel to the neutral position. To my relief, I saw the rate-of-climb indicator swing slowly past center, indicating a slight glide, then return to neutral. I was flying level at 1,100, but the wheel



These air-brake flaps make it possible to land the plane at twenty-five miles an hour

seemed to be pulling against my hands.

Cautiously, I felt for the stabilizer control knob, somewhere near the level of my left knee on the column which supports the wheel. First, I attempted to wind clockwise, but found the control could not be moved. I quickly deduced that this represented a heavy nose, that I must wind to the left.

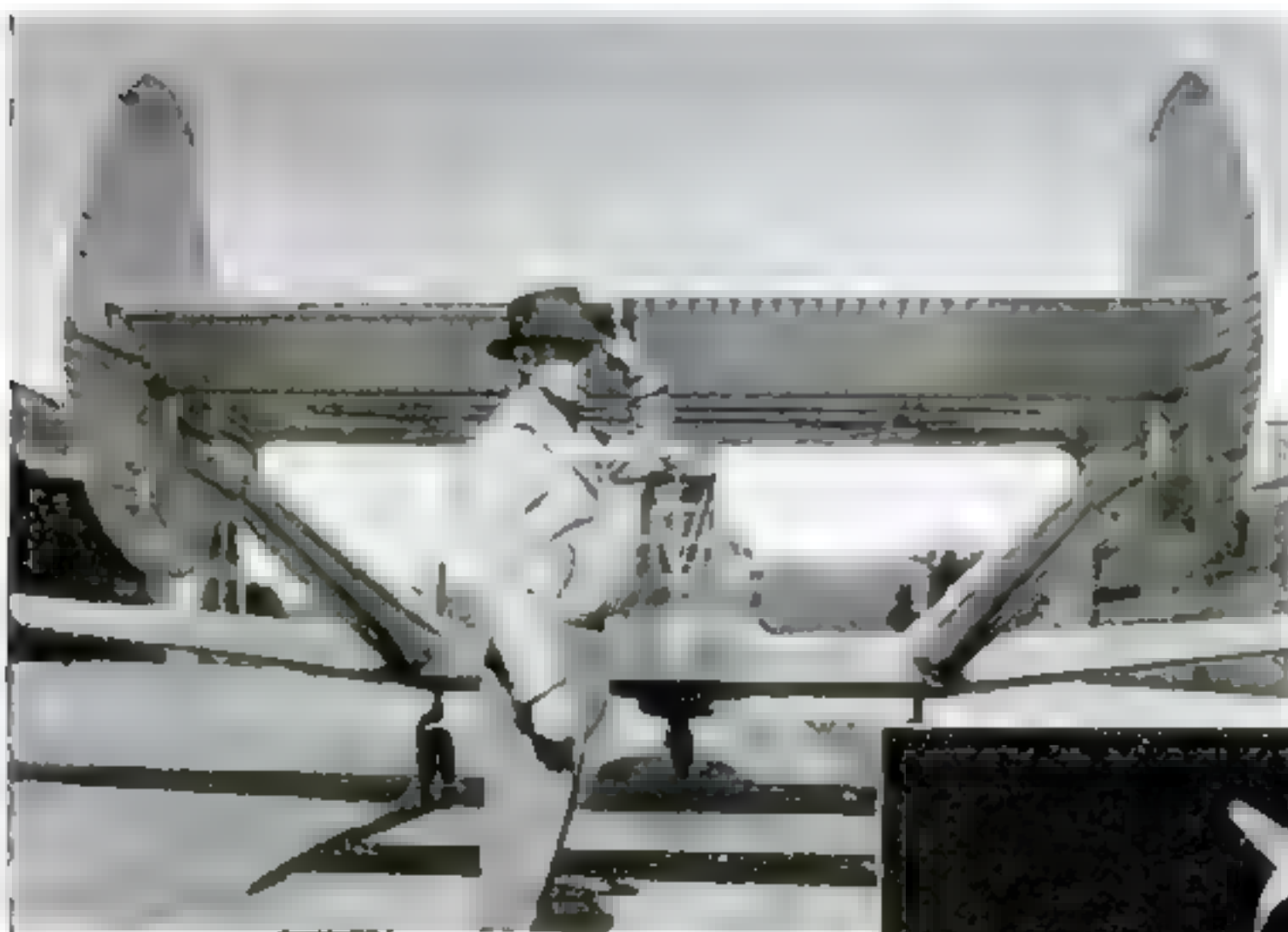
Slowly I cranked two turns, perhaps three, when suddenly the wheel pressure disappeared. I looked at Slim, relieved by this discovery.

"She's O.K.," he reassured me. "The plane will fly herself now."

Perhaps, but my muscles were taut and I was not quite ready to relax my uncertain control. It seemed our wheels were about to brush across the crest of the low hills lying under our starboard quarter, although calm judgment told me these were no closer than a half mile. Instead of relaxing, I fed a little more gas to the motor and started climbing again. At 2,000 feet I felt safer, and leveled off once more.

"What do we do now?" I asked, growing bolder. (Continued on page 94)

The tail assembly is seen at the left. Right, a mechanic adjusting the cowling above the 150-horsepower motor. The photograph below shows the author and Slim Perrett pushing the little plane out of its hangar



Here's the Latest Answer to the Growing Demand for a Plane for the Amateur. If You Can Drive an Auto, You're Ready for the Air

**By
ANDREW R. BOONE**



Life Preserver Is Self-Inflating

HELD across the chest by a lightweight strap, a compact life preserver for swimmers measures less than ten inches in length and weighs under six ounces. Made of tough, pliable rubber, the unit contains chemical charges which, when released by squeezing the rubber, combine to inflate the bag with a harmless gas. It is said to support the average person in the water for sixteen hours.



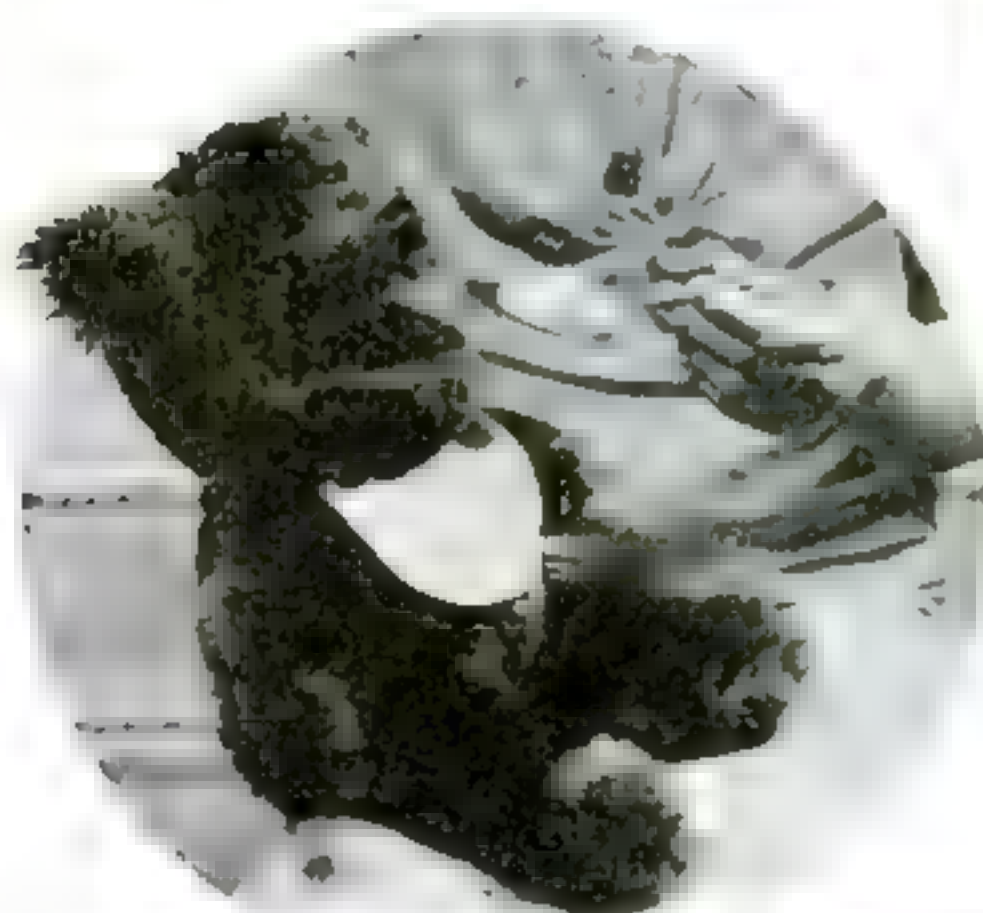
The life preserver inflated, holding the user's face above water. The view at left shows how it is worn



Odd Metallic Material Made from Seaweed

Seaweed is transformed into silvery metallic fibers by a chemical process worked out by Ed Townsend, Hermosa Beach, Calif., mineralogist and engineer. Gathering rare seaweeds on the beach after a storm, Townsend subjects them to a curing process and then to a long chemical operation which is said to produce fine metallic strands, indestructible but soft as tissue, for use in decoration.

This Toy Bear Feeds on Candy and Cereals



This little bear is fond of candy. Food is removed through a slit as at right



CHILDREN can feed candy, animal crackers, dry cereals, and other morsels to a novel toy bear which actually "eats" its food. When a ring is pulled, the bear opens its mouth in an amusing and realistic manner. Food disappears into the toy animal's interior, and is later removed through a hole in the back covered by a slide fastener. Made of plush and mohair, the toy bears measure about eighteen inches in height.



A point on the tool pries the disk-type cap from the wheel..

Tool Removes Auto Hub Cap

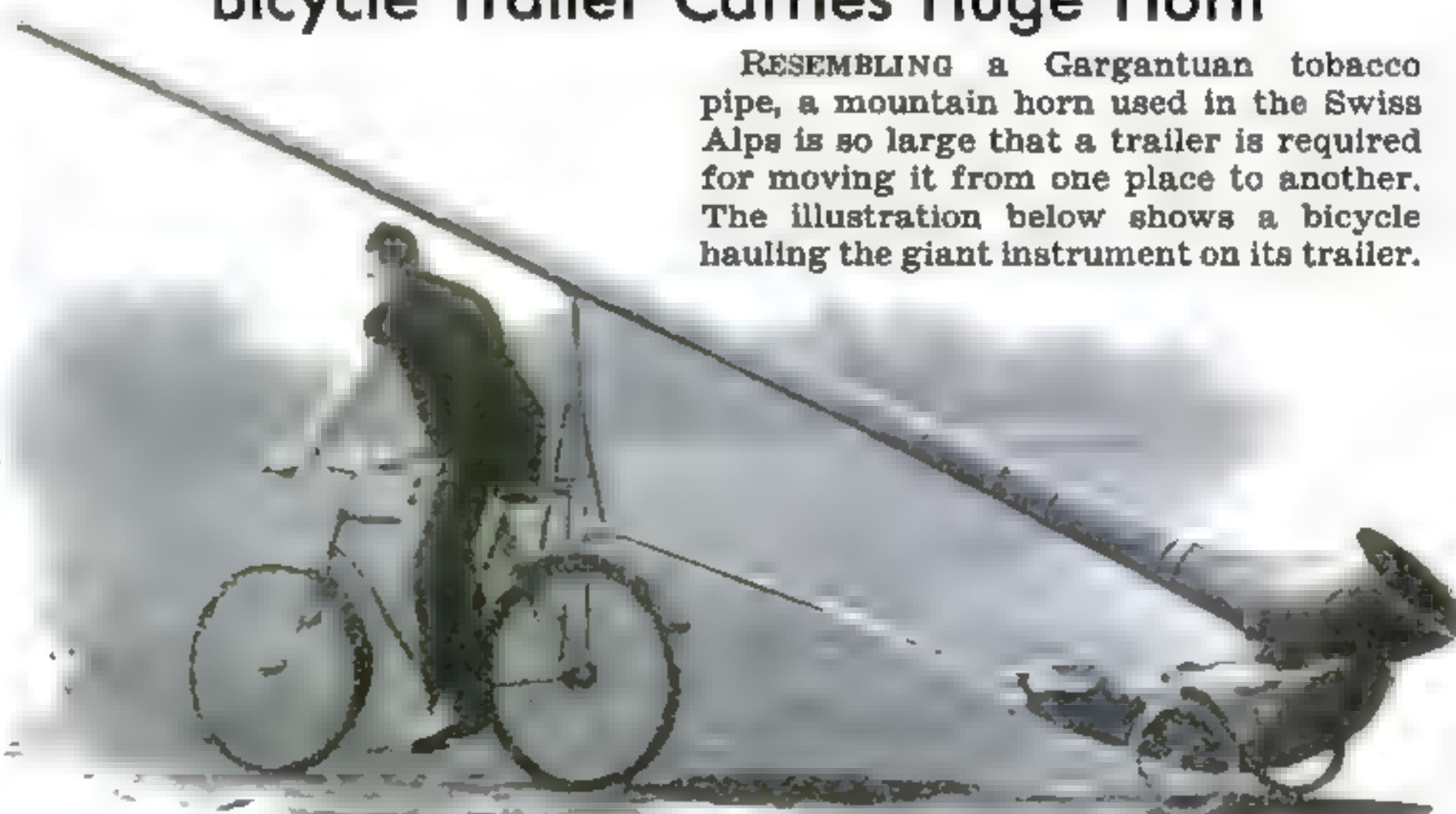
DISK-TYPE automobile hub caps are quickly removed with an ingenious tool invented by Henry Blomgren of Upper Darby, Pa. As pictured at the left and right, the flat point of the tool pries the hub cap out from the wheel, and two adjustable vacuum cups hold it to prevent its falling and becoming scratched or marred by contact with the ground.



and two adjustable vacuum cups hold it so it cannot fall

Bicycle Trailer Carries Huge Horn

RESEMBLING a Gargantuan tobacco pipe, a mountain horn used in the Swiss Alps is so large that a trailer is required for moving it from one place to another. The illustration below shows a bicycle hauling the giant instrument on its trailer.

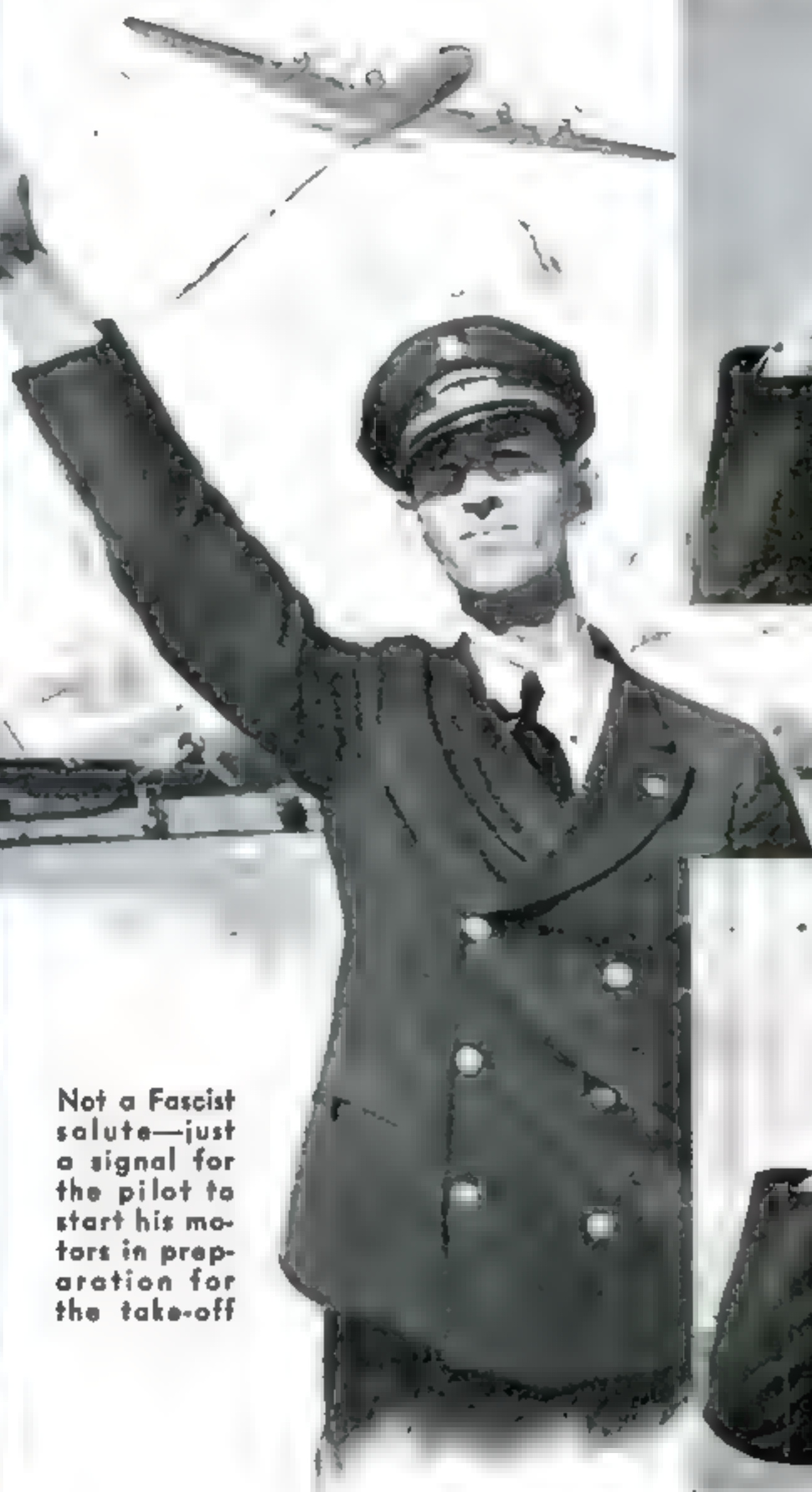


Somebody asked this Swiss to come over and bring his horn

Airport Sign Language Gives Pilots Their Orders



This says "You're leaving on time"



Not a Fascist salute—just a signal for the pilot to start his motors in preparation for the take-off



"On the nose"—arriving on time



Wigwagged hands hold up a take-off temporarily



"So long," to the pilot. "Everything's O.K."

How passenger agents on the field signal transport-plane pilots about to take off or taxi to a landing ramp is revealed in the photographs above. At the upper left, the agent curves his thumb and index finger into a circle to tell the pilot his ship is taking off on time. Crossed arms are wigwagged to

hold the take-off temporarily. In the center, the agent's raised right arm means "Start your motors." The nose-pointing gesture signals incoming pilots that they are "on the nose," or on time, while the half-salute at the lower right says, "So long—everything's O.K."

Chart Gauges Child Health

INFORMATION concerning the health of children between the ages of four months and six years is provided by the handy chart illustrated below. Worked out by the New York City Health Department, the chart has two circular, printed disks held together at the center. By rotating the upper disk, a mother can set the chart at the approximate age of her child, and then read off the normal weight, height, physical behavior, and diet of average youngsters of the same age. The reverse side of the chart contains information on the development of the teeth.

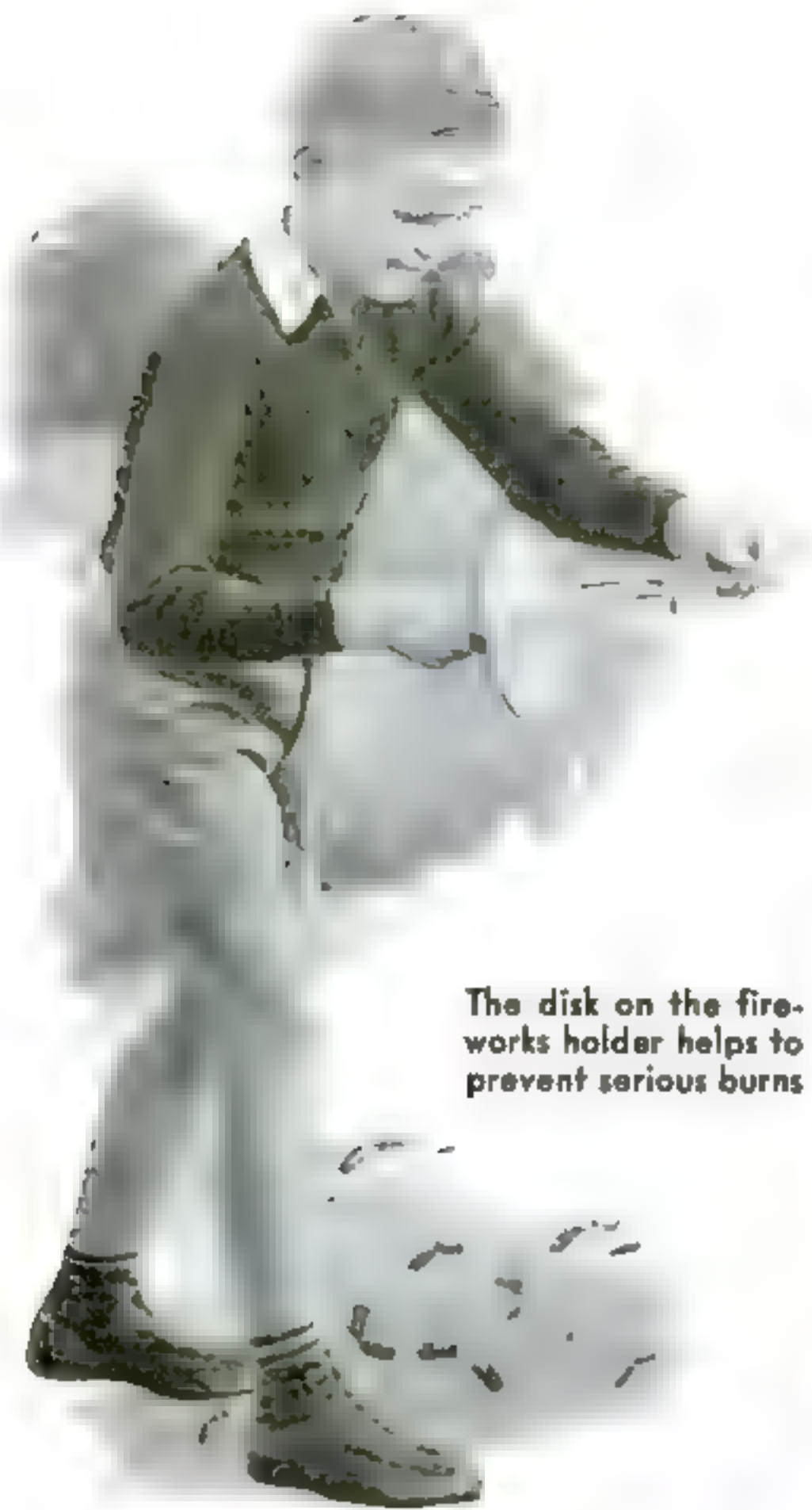


By rotating the upper disk, a mother can set the chart at the approximate age of her child, and then read off the normal weight, height, physical behavior, and diet of average youngsters of the same age. The reverse side of the chart contains information on the development of the teeth.



Motor Scooter Has Side Car

POWERED by a $1\frac{1}{2}$ -horsepower gasoline engine, a motorized scooter is fitted with a side car having a capacity of 300 pounds. Designed as a low-cost delivery unit for small parcels, the vehicle has a maximum speed of thirty-five miles an hour and is said to travel 100 miles on a gallon of fuel. Other features of the novel car include two-speed transmission, a foot-operated starter, and heavy-duty brakes.



The disk on the fireworks holder helps to prevent serious burns

Safety Fireworks Holder

SHOOTING off fireworks is made safer by a new protective device consisting of a disk having a handle on one side, and a hollow tube and shallow trough on the other. Before igniting, firecrackers are placed in the trough, and Roman candles in the tube.

Novel Slot Machine Dispenses Ice Cakes

WHEN no attendants are present at the plant of a Muncie, Ind., ice company, customers can still obtain ice by dropping a dime in a slot machine. After the coin is inserted, electric motors move a conveyor mechanism so that a block of ice in the cold-storage room enters a runway and slides down within reach of the purchaser. Tongs are furnished by the ice company for use by the customer in carrying the slot-machine ice cake to his car or truck after the purchase is completed.



Putting a dime in the slot machine at left automatically starts the conveyors, delivering a twenty-five-pound chunk of ice. Two dimes deliver fifty pounds

Piano Recorder Aids Composers



How the recorded piano notes appear on paper

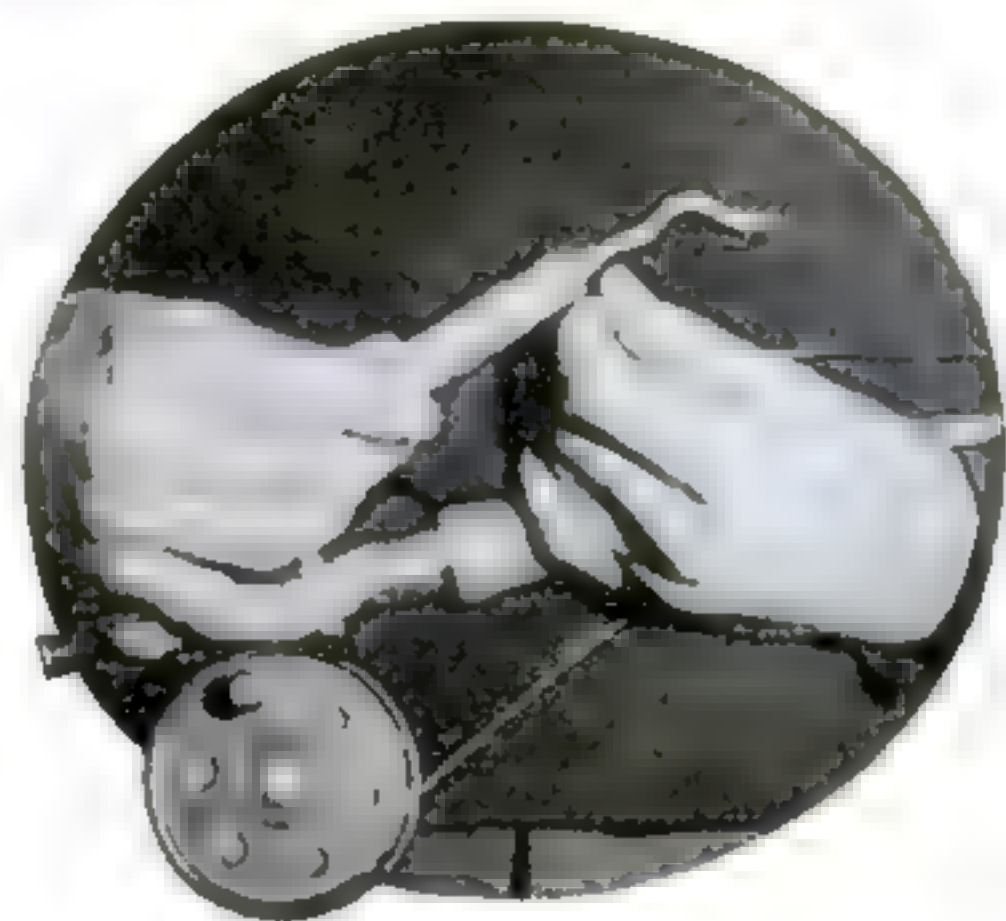
Right, the notes after transcription into music



MUSICIANS composing at the piano may forget the thread of their melodies when they have to stop playing to jot down the notes. To overcome this handicap, an instrument just invented in Germany is reported to record the notes automatically as they are played. As each key is struck, the machine marks a symbol on a moving tape so that the tune can be reproduced in standard musical form at a later time.



One too many matches will topple the pile, ending a player's turn

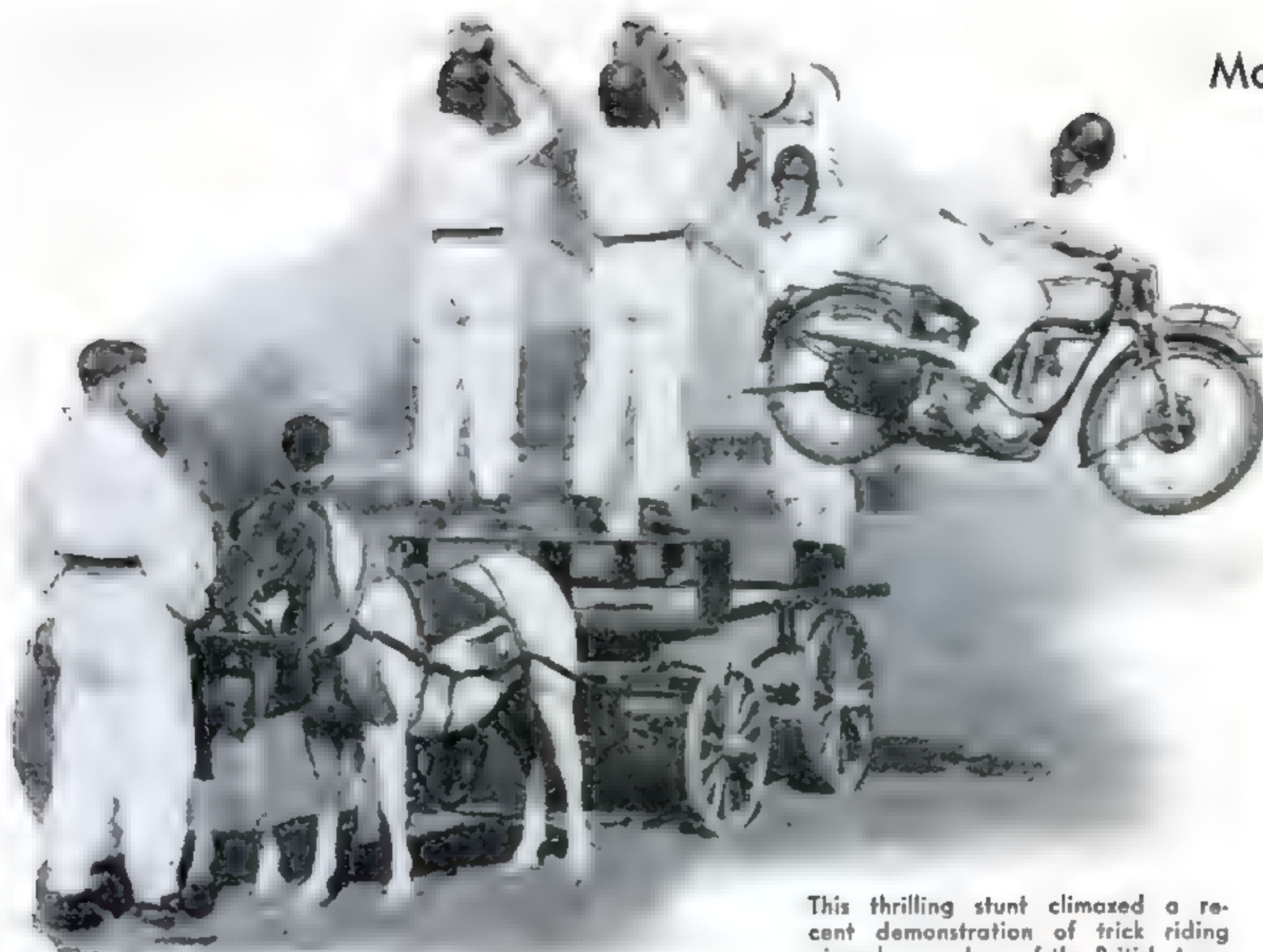


False Worm Fools Fish

AN ARTIFICIAL worm, made of transparent rubber and filled with a paste that attracts fish, is now available to anglers. In the water the paste dissolves in about an hour, after which the "worm" can be refilled by means of a pointed filler tube.

Match-Balancing Game

STACKING piles of match sticks on a cardboard cone is a new game that demands skill, patience, and steady nerves. Seven inches high, the cone is topped with a cork tip to prevent the headless matches from slipping. Sticks included in the set come in four different colors.



Motor-Cycle Acrobat Leaps Through Human Arch

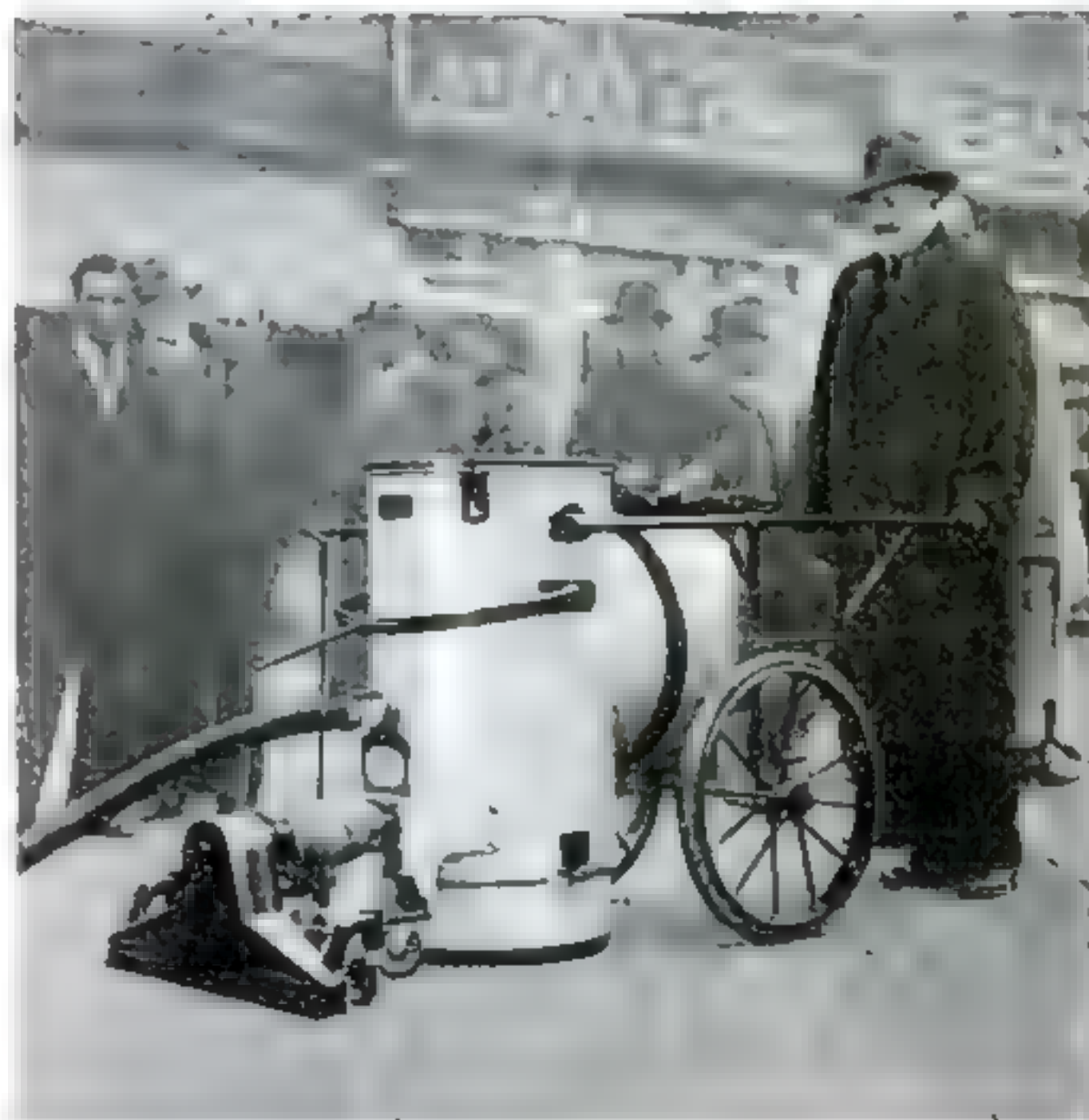
MOTOR-CYCLE acrobats recently put on an exhibition of dare-devil skill at a military camp in Yorkshire, England. The riders were all members of the signal division of the British Army. The climax of the show was a leap through a human arch. Six men, wearing crashproof helmets, climbed to the top of a pony wagon. Four of the performers lifted the rigid bodies of their two companions above their heads to form the arch. Toward the wagon, a rider streaked down the field on his roaring machine. He struck an incline, shot upward in a leap that carried him over the wagon and through the arch formed by the men. This spectacular stunt was caught by a high-speed camera and the resulting picture is shown at the left.

This thrilling stunt climaxed a recent demonstration of trick riding given by members of the British Army



Vacuum Sweeper Cleans Seaside Boardwalk

TRUNDLED along on its two wheels, the big vacuum cleaner pictured at the right simplifies the problem of sweeping the oceanside boardwalk at an Atlantic beach resort. The self-loading mobile ash can is powered by a built-in gasoline motor that drives a fan blade creating suction and drawing up stray bits of paper, cigarette butts, and other trash. Caster wheels support the cleaner head close to the boardwalk planks, while a rubber hose, seen extending out to the left of the picture, terminates in a nozzle for sucking up litter along the railings and beside the walk.



New Electric Razor Has Self-Sharpening Blade

AN ELECTRIC razor of new design, now available to shavers, has a self-sharpening spiral blade unit that operates like a lawn mower. The cutting mechanism, rotating 266 times a second, consists of four honed edges protected by guide fins.

Curved Watch Fits on Side of Wrist

BECAUSE experiments proved that watches worn on the side of the wrist are less subject to bumping and scratching, the timepiece pictured in the photograph at the right has been placed on the market. Shaped to fit, the novel watch is made possible by a special curved movement that is said to be just as efficient and rugged as larger movements designed to be mounted in the ordinary flat wrist watch.



Besides being convenient, a watch worn in this position is said to be less liable to injury

Rainproof Garden Marker

TINY glass bottles, sealed with corks and mounted on stiff wire stakes which can be stuck into the ground, provide weatherproof coverings for written paper markers that identify plants or flowers in a garden. When the growing season has ended, the bottles may be used for storing seeds for planting.



How I Became a



Neighbors of the head-hunters—
a family of Borneo orang-outans

**An American Explorer
Tells a Weird Tale of
Thrilling Adventures
Among the Wild Tribes
of the Borneo Jungle**

**By
LEONARD CLARK**

A Dyak warrior of Dutch Borneo. His tribe still clings to its primitive way of life. At right, a view of the author in the jungle

"YOU will never make it," the Dutch colonials at Surabaya, Java, had told me. "The Dyaks will murder you while you sleep . . . cut off your head . . . and lay your body on a termite hill to remove all evidence of head-hunting!"

In spite of this tart warning, I went to Borneo to learn, if possible, whether head-hunting was still practiced in our day—and if so, how. Nearly two months later, after penetrating the bush 200 miles beyond the rancid swamps fringing the east coast of Borneo, I stood well within the borders of the head-hunting Lawangan territory—the most remote of all the inner tribal areas. Even now, I did not suspect that I was soon to learn a great deal about head-hunting as practiced today, and that I was to be made a member of one of the oldest brotherhoods known to man—the head-hunting society of Borneo.

My position from this point on, in regard to personal safety, according to the Dutch officials in Java and in Banjermasin, the capital of Borneo, would be a risky one. For days on end the witch doctors' drums had vibrated throughout the forest, carrying the news of our presence. My entire party of coastal Malay porters had become jumpy, and some were frankly scared.

Since childhood, they had been frightened into being good with stories of "the wild men of Borneo." I had reached a *kampong* (village) of several hundred Dyaks—thus far peacefully enough. Later I was to learn that the warriors had been out searching for my Malays and me. Upon returning empty-handed to their *kampong*, and finding me camping in blissful ignorance in the shade of the huge long-house, they were surprised, to say the least. But since I had taken no heads from the old men, women, and children left behind, I was by right of Dyak law an ally and friend of the tribe. And now the shrewd-looking *kapala* (chief) seemed very anxious that I should be impressed by the fact that he and his warriors no longer hunted humans to obtain heads for their witch-doctors' ceremonies; they now hunted only for wild-animal heads!

I was greatly relieved to hear this, but I was extremely dubious after hearing the whisperings of my Dyak guide, recently turned Mohammedan, to the contrary. The *kapala* naturally would like me to convey this rather startling news of reform to the Dutch Resident at Banjermasin. The drums, which are

the radios of the jungle people, had recently informed the tribe that talk was current on the coast concerning a military expedition entering their country to investigate the head-hunting set-up!

On the second day after my arrival in the *kampong*, I slipped the leash long enough to peek into that holy of holies, the head house, a mysterious structure perched on tall sticks near the circle of trees, and found that its smoky rafters accommodated skulls and more recently cured heads—old ones that were yellow where the bone showed through, and a few fresh ones that gleamed like black tar; and they didn't resemble any animals I had ever seen!

SINCE it was important to continue my friendship with the Dyaks, I did all I could to be agreeable. On the second night I accepted the *kapala's* invitation to accompany him and his finest warriors into the bush on a ceremonial head hunt the next day. So far as I know, I am the only white man who was ever included in a modern head-hunting party in Borneo. Even Maanyan, my Dyak guide, accepted with an

Head-Hunter

eagerness that was surprising to me, for he was a "civilized" coastal native. The Dutch have repeatedly claimed that if they left Borneo, within one year the great island would again revert to wholesale head-hunting.

In the green dawn light, the *kapala*, Maanyan, and I started with a dozen of the warriors down a trail that wandered aimlessly through the dripping bush sagging with morning dew. Swiftly we moved along in single file. Half an hour later, we left the trail and cut our way over a hill and down into a mossy swamp that was sticky with mildew.

FAT clouds of buzzing mosquitoes settled on the naked bodies of the Dyaks, but the men were not annoyed and moved on swiftly, apparently intent on the hunt ahead. Soon we crossed the swamp and reached higher ground. With almost incredible speed and silence the warriors moved along the gloomy jungle floor between fluted trees so large that a man could hide easily among the exposed roots.

One of the hunters out of my sight on our left flank raised his voice in a shrill imitation of the call of a monkey. Instantly we froze. A flashing light of excitement seemed to dart from the savages' eyes; lean, long fingers tightened their brown grip on polished spear hafts. My

ears began throbbing from the whir of countless insect wings beating on the moist air. Then it happened.

In front of me, a monster of prehistoric size smashed crazily through the jungle growth. A huge grey beast, remarkable in its likeness to a horned toad, stood trembling twenty feet away.

"Bada! Bada!" hissed the Dyak nearest me.

A rhinoceros! Suddenly the armored pachyderm wheeled and tore through the lianas and trees like a war tank. Incredible silence followed. A tall, coppery warrior raised his spear cautiously. We advanced, slowly.

In ten minutes some *rusa* and *muntjac* (deer) leaped up ahead of us and crossed a stream. No effort was made to spear them; evidently the head-hunting ceremony needed more important game than deer, for the hunters allowed them to go on their way unmolested.

Nearly an hour later, the warrior advancing on my left glanced upward into the trees overhead. Following his gaze I saw a silvery *wah-wah*. Apparently the great ape was not at all alarmed, but curious as to what we were doing in his private jungle. He began a weird warble in a minor key which presently leaped to such a piercing crescendo of warbles that chills raced along my spine.

One of the alert hunters shot a scaly anteater with his *sampitan* (blowgun) and threw the heavy reptile over his shoulder and the party kept on. The sun was



This is a human head, shrunk to hen's-egg size by a secret process

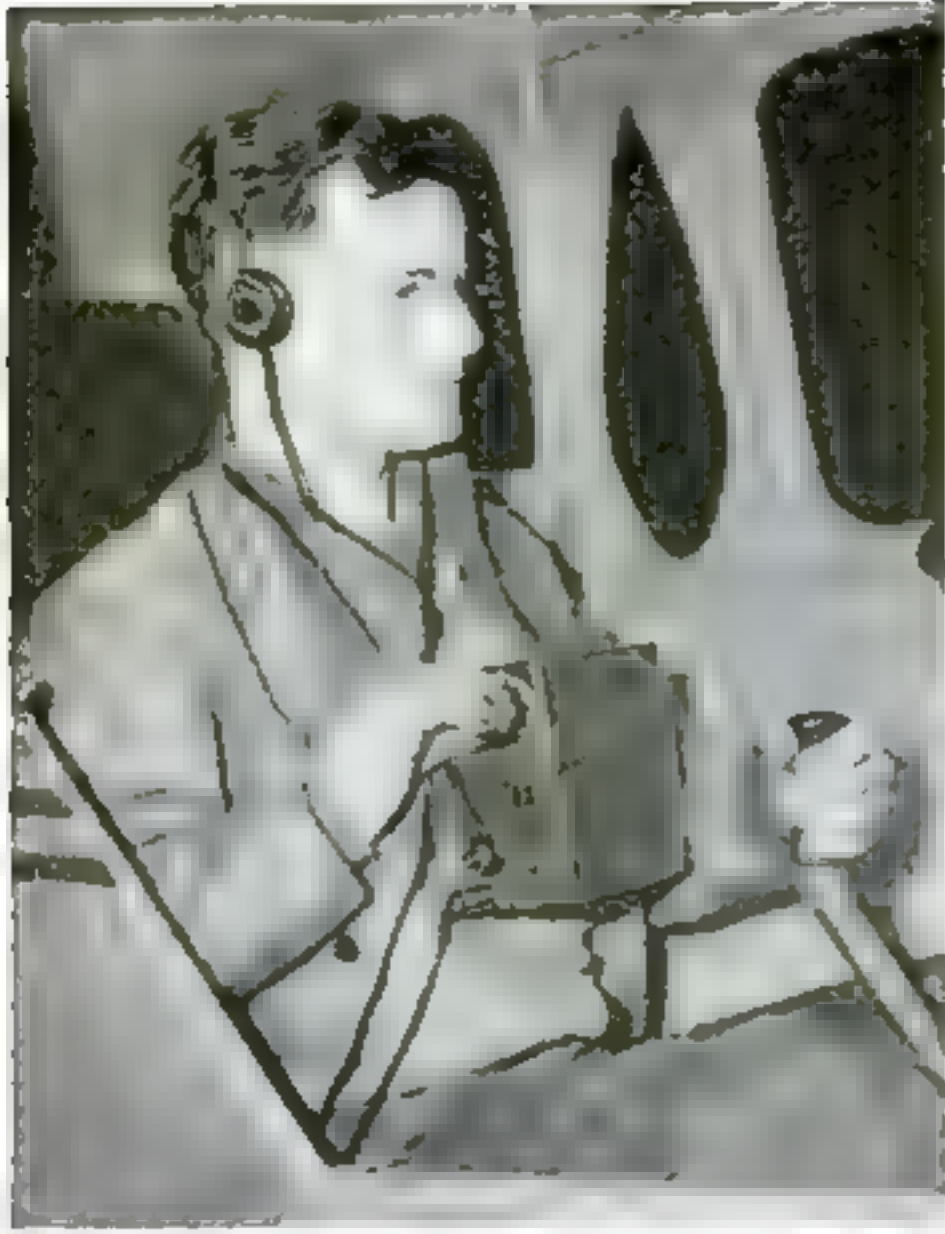
directly overhead when we finally broke through the bush to a small swampy lake. The place was haunted by old ghosts of dead trees, white and starkly bleached, and covered with orchids. We had not progressed far along the shore of the lake when a near-by warrior whispered, "*Babi hutan!*"

Somewhere ahead, wild boars had been seen—or smelled! The Dyaks claim that they can scent many kinds of animals in hunting them. Swiftly the Dyak hunters spread out and marched on, taut and ready with their heavy spears. Suddenly, only 100 feet away, I saw two shaggy beasts standing in shallow water near the shore. They were
(Continued on page 83)



The size of these trophies is seen by comparison with the man's hand. Right, a grisly display in front of the tribal house in a Malay village



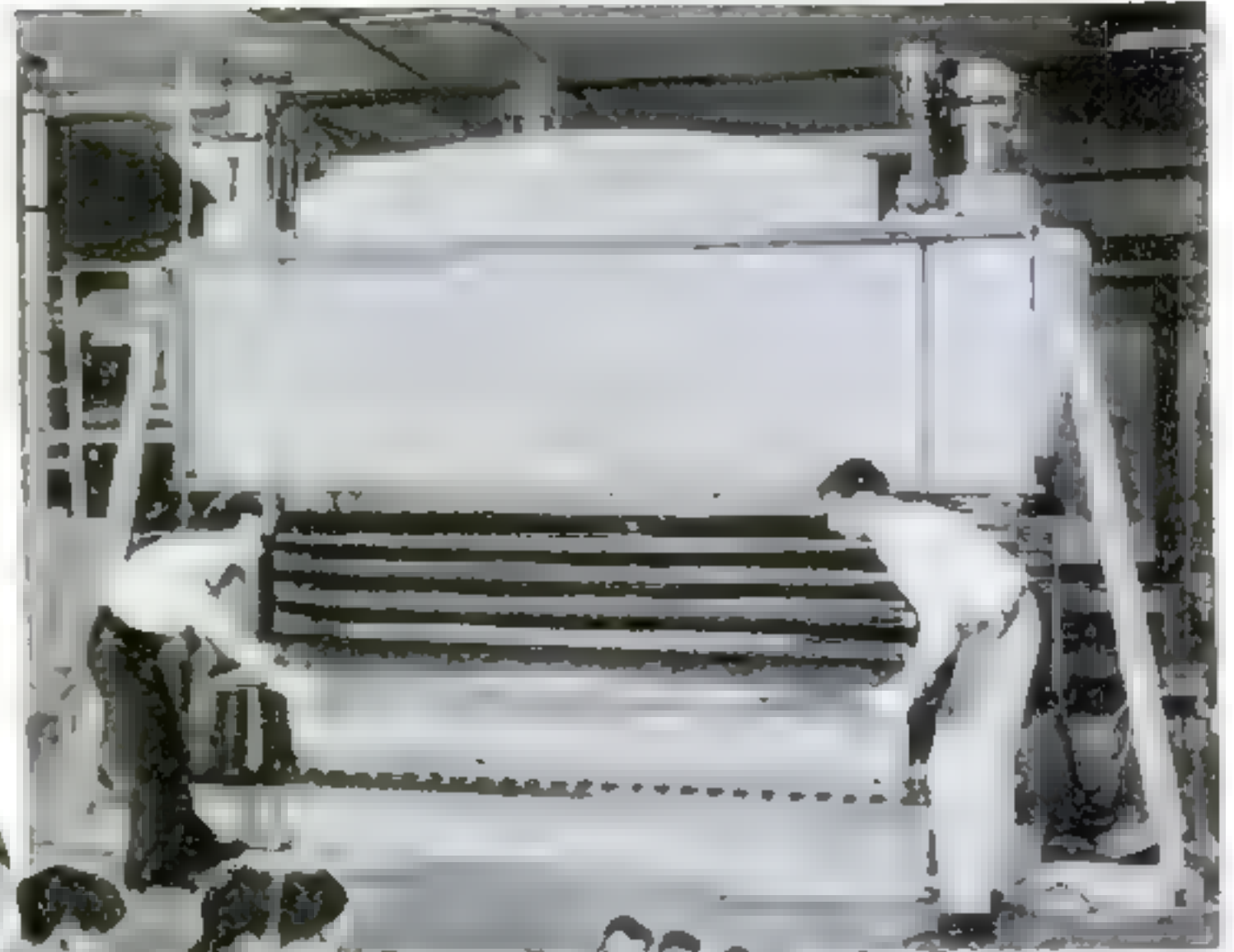


Tiny Radio Hangs from Strap on Pilot's Neck

HARDLY larger than a box-type camera, a compact new radio receiver for private planes can be slung around a pilot's neck or taped to the control stick. Consuming little power, the receiver has a range of 200 miles and picks up regular beacon and airway-beam signals, as well as voice broadcasts in frequencies of 200 to 400 kilocycles.

New Process Yields Tough Veneer

REDUCING the time required for applying veneers to wood from weeks to minutes, a revolutionary new process has been introduced. The heart of the new operation is a gigantic hot-plate press and a liquid-resin glue. The accordionlike press cements the layers so that ten men pulling in a tug-of-war cannot separate them.



Placing layers of special glue and wood inside the huge veneer press

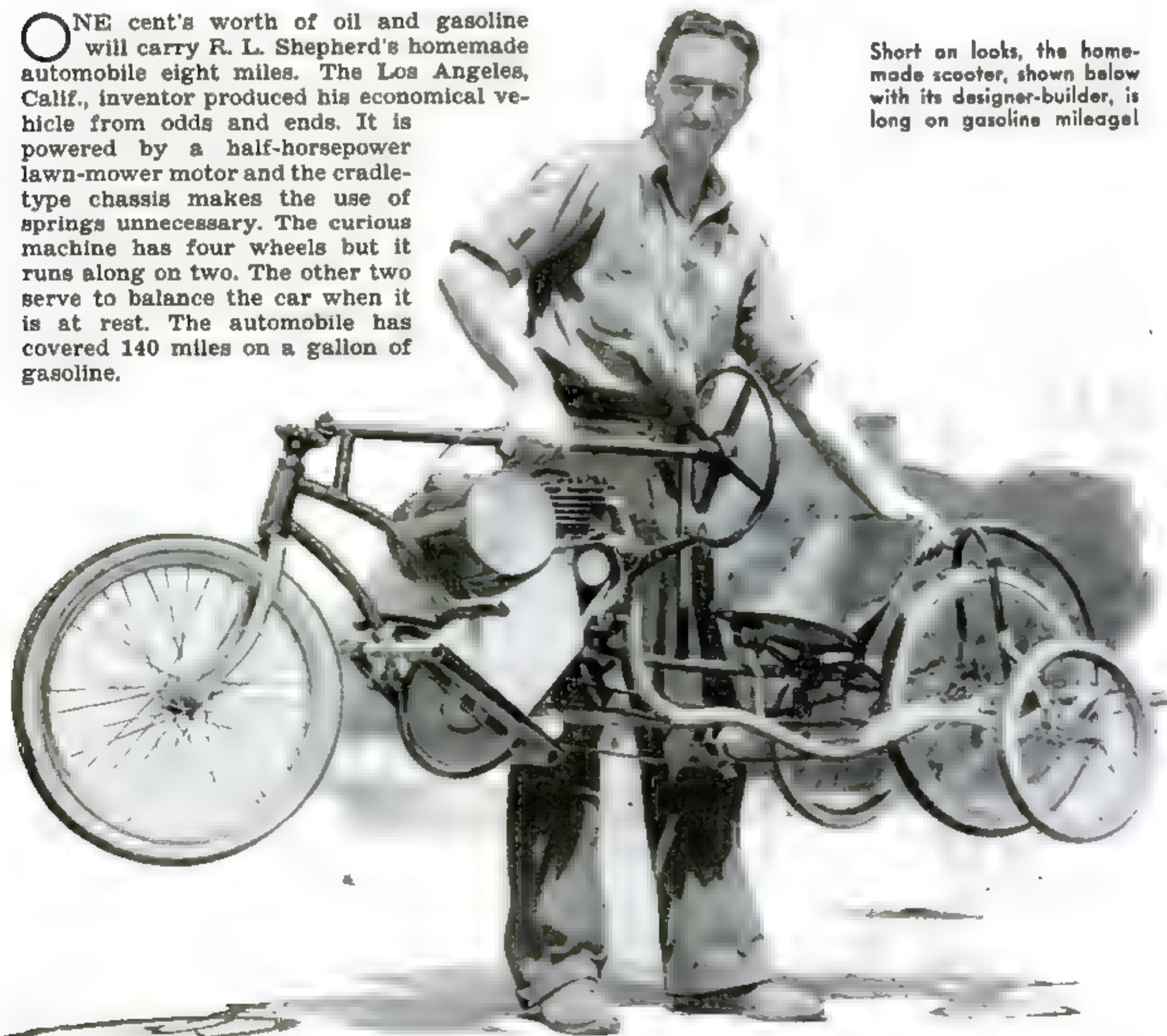


Left, a ten-man tug-of-war fails to split apart the new veneer

Homemade Car Goes 140 Miles on a Gallon

ONE cent's worth of oil and gasoline will carry R. L. Shepherd's homemade automobile eight miles. The Los Angeles, Calif., inventor produced his economical vehicle from odds and ends. It is powered by a half-horsepower lawn-mower motor and the cradle-type chassis makes the use of springs unnecessary. The curious machine has four wheels but it runs along on two. The other two serve to balance the car when it is at rest. The automobile has covered 140 miles on a gallon of gasoline.

Short on looks, the home-made scooter, shown below with its designer-builder, is long on gasoline mileage!



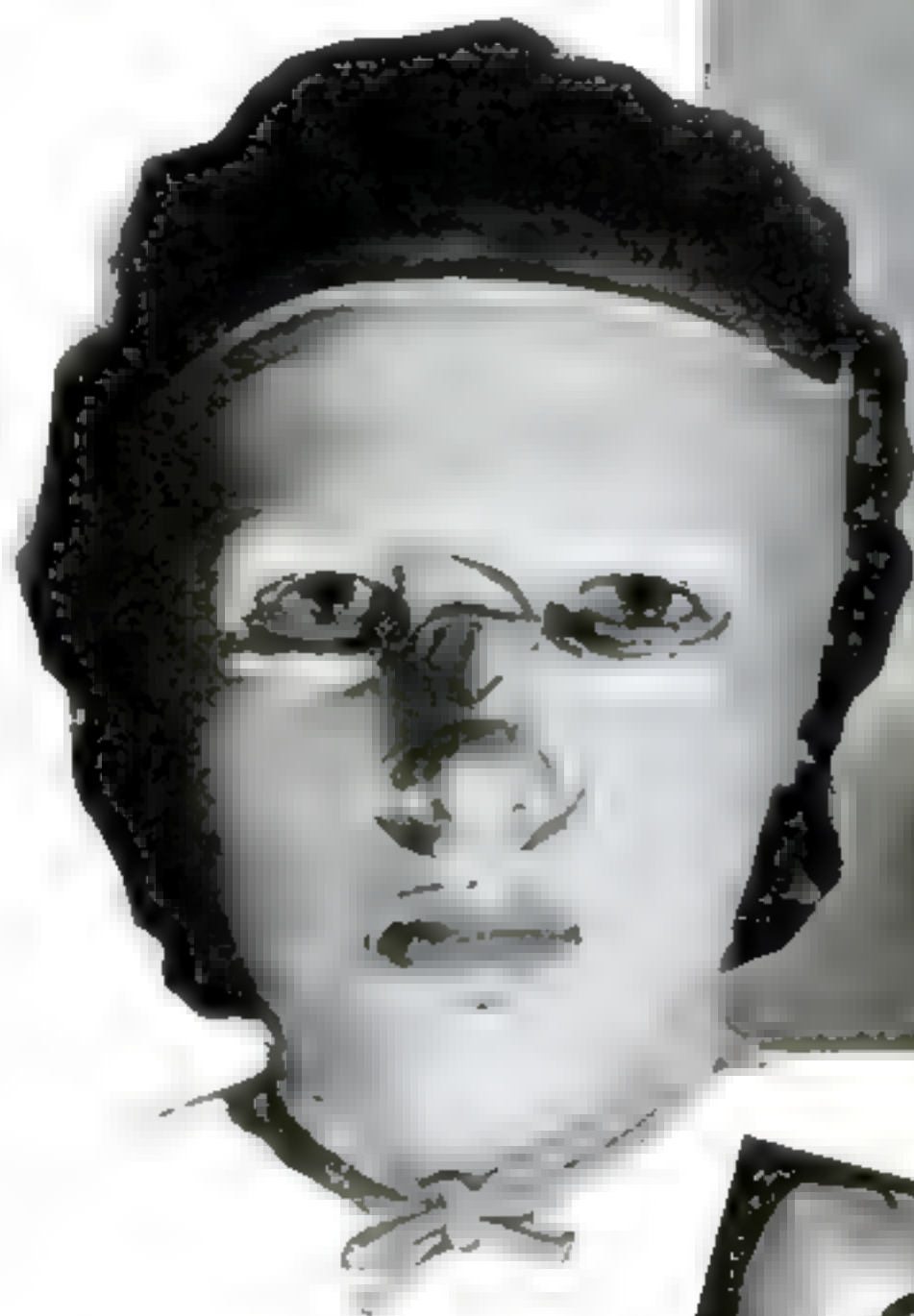
Walking-Stick Weed Killer Is Easy To Use

PRESSURE on the control button of a new canelike weed killer, after the point of the instrument has been thrust into the ground, shoots a fluid among the roots of a plant pest. From seventy-five to 300 weeds can be killed with one filling. It can also be used for destroying ant hills.

SCIENCE IN THE *Beauty Shop*

**Inventors Supply Ingenious Devices
for Improving the Face and Figure**

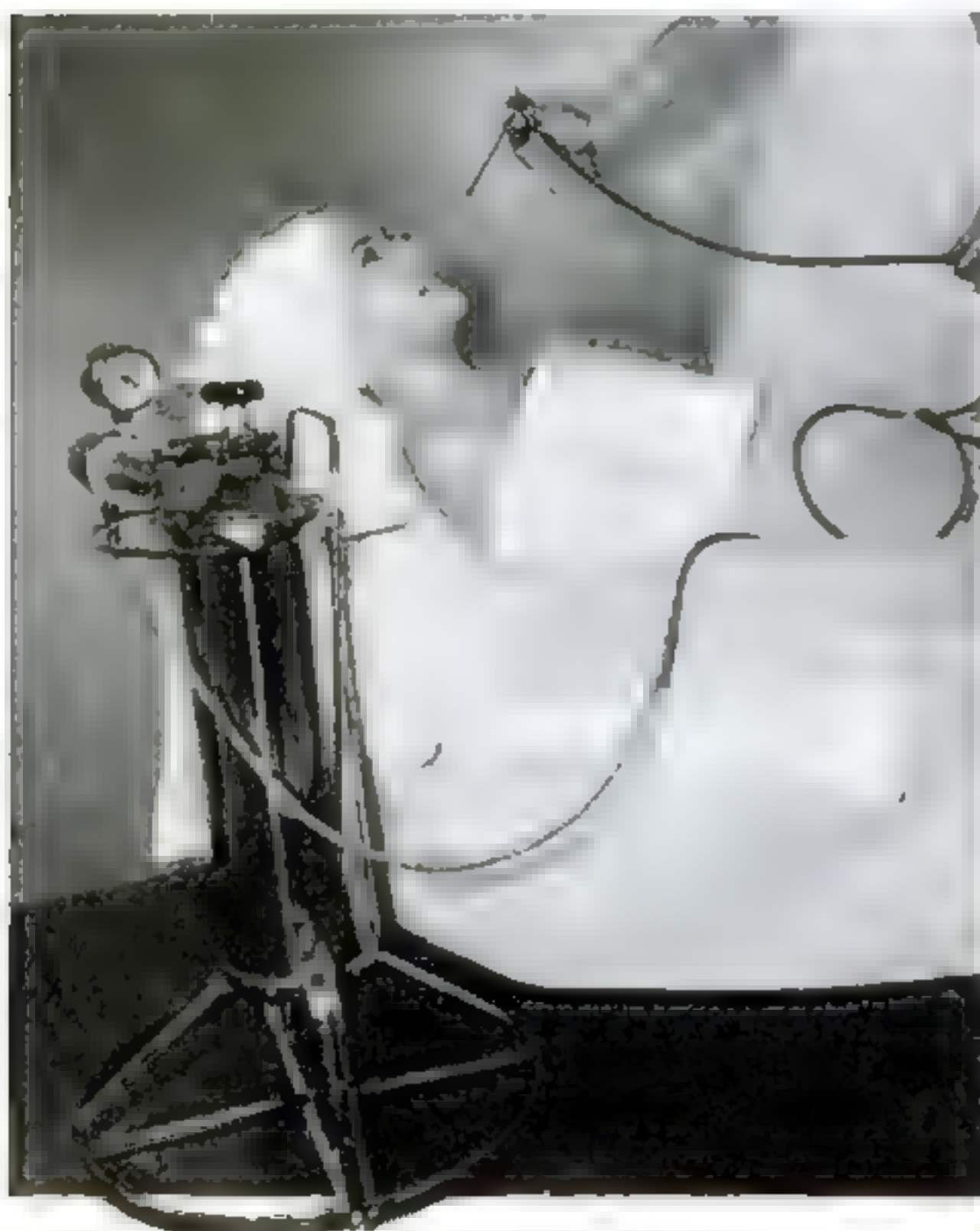
SCIENCE has invaded the beauty shop. In an effort to improve the faces and figures of the nation's women, inventors have answered the call for mechanical aids in the war on wrinkles, double chins, sagging muscles, and rough complexions. Diagnosing individual cases much as a medical clinic examines its patients, the modern beauty shop corrects flaws with the aid of ingenious devices, some of which are pictured in the photographs on this page. The treatments range from picking up small rolling pins with the toes to limber and strengthen instep muscles, to undergoing "skin-oxylation" operations in which live oxygen is filtered through a herbal fluid and sprayed on the face with a compressed-air gun to liven up dull skin texture. To lift sagging facial contours, a mask of treated silk is dipped in a special lotion and fitted on the face, holes being provided for the eyes, nose, and mouth. Tightening as it dries, the mask is said to make drooping skin firm and smooth.



This silk mask is saturated with a lotion that contracts to brace flabby facial contours



VAPOR FACE BATH. As a preliminary to many facial treatments, this machine blows a warm, herbal vapor against the skin to cleanse it of accumulated soot and grime



SKIN OXYLATION

Live oxygen, filtered through a herbal fluid, is being sprayed on this woman's skin with a compressed-air gun. Absorbed through the pores, the gas is said to restore vitality to dull, lifeless skin



ELECTRICAL TREATMENT

Droopy lines and crepe-like texture in the chin and upper throat, where age often makes its first appearance, are corrected by a local application of electricity. The subject grasps an electrode to "ground" the current

AND THE FEET, TOO

Picking up a miniature rolling pin with the toes, as seen at the left, is an exercise recommended for limbering up the toes and for strengthening instep muscles



Air Scoop Cools Motor

SCOOPING up air and carrying it directly to the rear cylinders, a device recently installed on a light plane by members of a Brooklyn, N. Y., flying club keeps the motor uniformly cool while the machine is in flight. Previously, the rear cylinders showed a tendency to overheat. The metal sheath was riveted to the cowl of the plane, as pictured above.

Helium Aids Treatment of Respiratory Ills

PNEUMONIA, asthma, and other respiratory afflictions are now being treated with a mixture of helium and oxygen. The combination is much lighter than air, and tests have shown that it is three times as easy for a patient to breathe as ordinary air. Thus a patient is able to get the needed oxygen through obstructed lung passages with less effort. A special machine has been designed by O. J. Smith, of Cleveland, Ohio, for mixing and administering the combination of gases.



Patient breathing mixture of oxygen and helium from special unit



Sneezing Machines Test Germ Screen

Left, one of the cubicles used in tests. Below, the device that sprays germs into the air



MECHANICAL sneezers, which shoot clouds of microbes into the air of a laboratory room, are helping research workers develop a new technique for "quarantining" disease germs. Within small, partitioned-off cubicles, the sneezing machines are set in action throwing off bacteria into the air just as a human being does when he sneezes. Circling the top of each cubicle is a series of tube-like ultra-violet lamps which give off rays that destroy the floating microbes. By perfecting ultra-violet "screens," the experimenters hope to prevent cold germs from spreading between patients in hospital wards.

Tailless Plane Has All Control Surfaces on Its Wings

WITH no more tail than a bumblebee, a curious monoplane was tested recently at Floyd Bennett Airport, New York City. Unlike former "tailless planes," its wings are not swept back to give inherent stability. Steering is accomplished by means of vertical rudders at the wing tips. The plane has a pusher propeller.



Elevator flaps attached to trailing edge of ailerons operate either individually or together

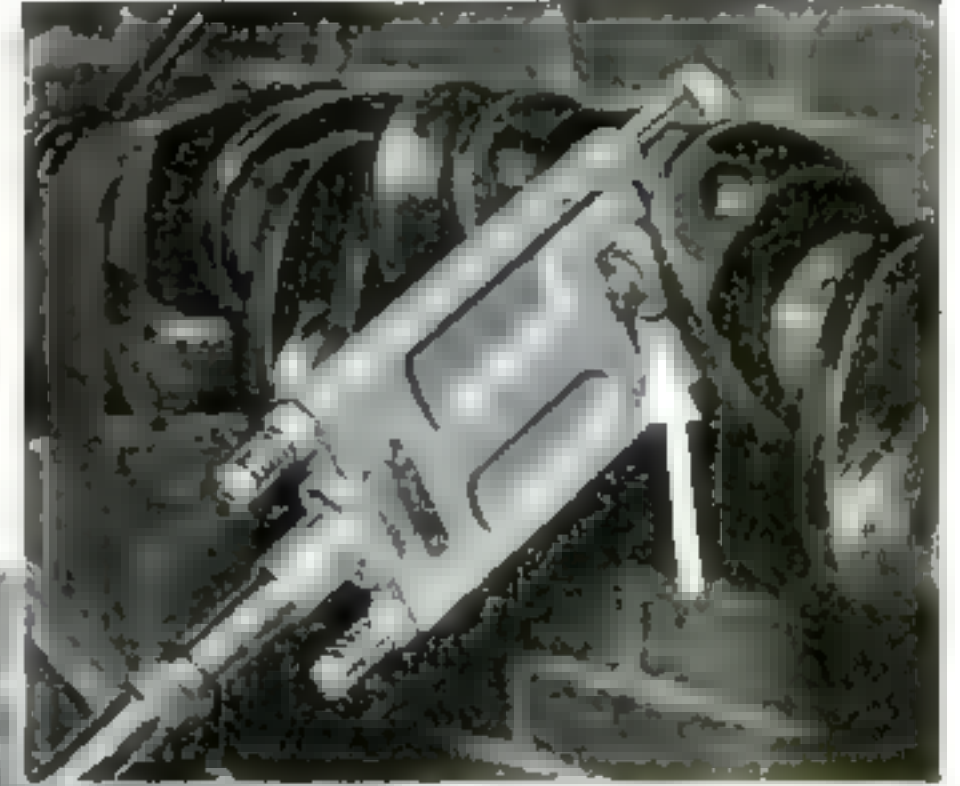


Sectional Fruit Crate Divides into Eighths

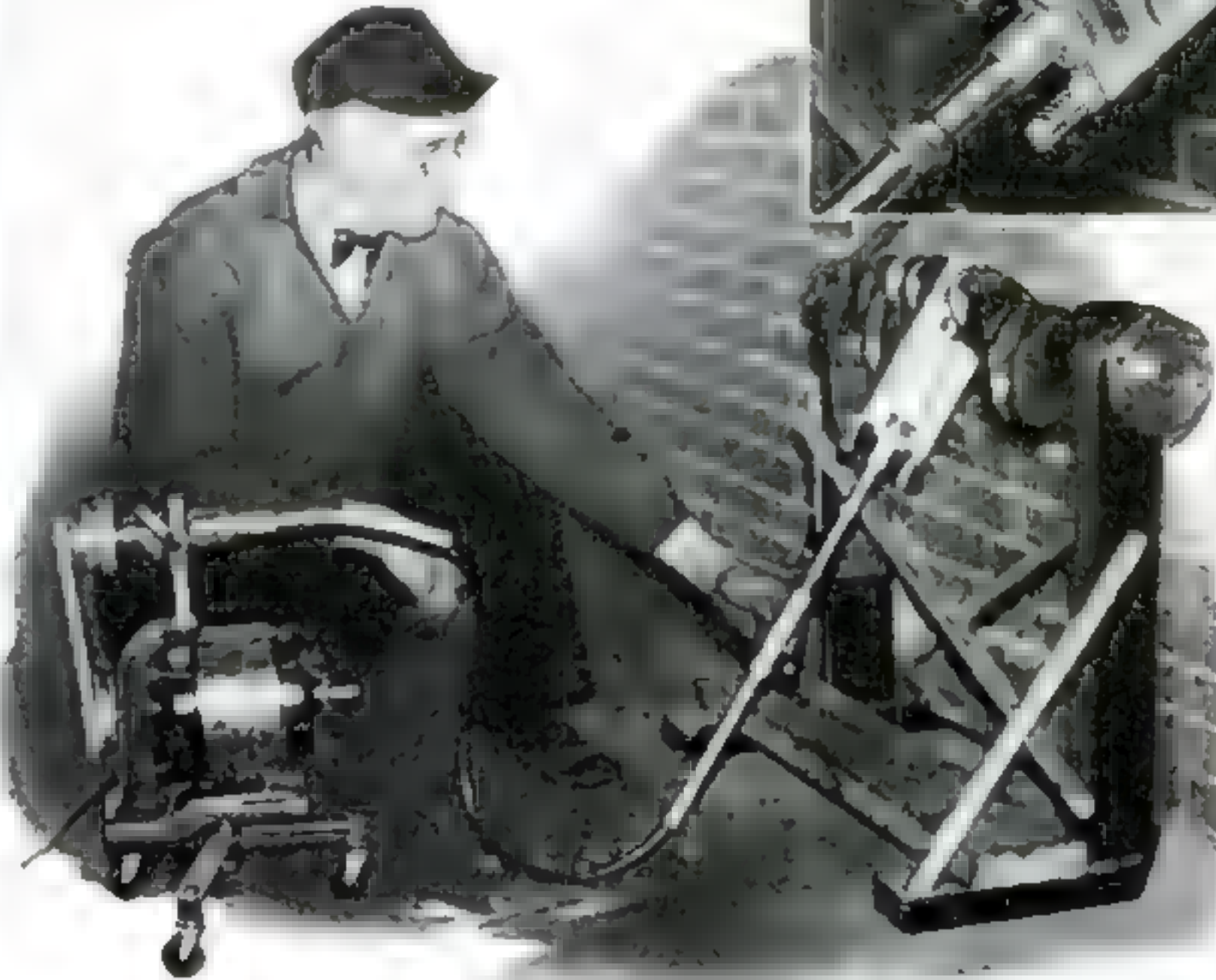
ORANGES and other fruits are now being packed for shipment in a novel sectional crate that can be divided into eight parts. Held together by staples pressed into the wood at the ends and sides, the sections make moderate amounts of the fruit available in the original container for home use.

Tool Grinds Auto Crankshaft in the Car

AUTOMOBILE crankshafts can be ground without removing them, with a new tool invented by G. H. Goulden of Denver, Colo. Driven by an electric motor through a flexible shaft, the grinder is placed over the crankshaft after the engine pan has been dropped and the connecting rods removed. The crankshaft is then turned by hand.



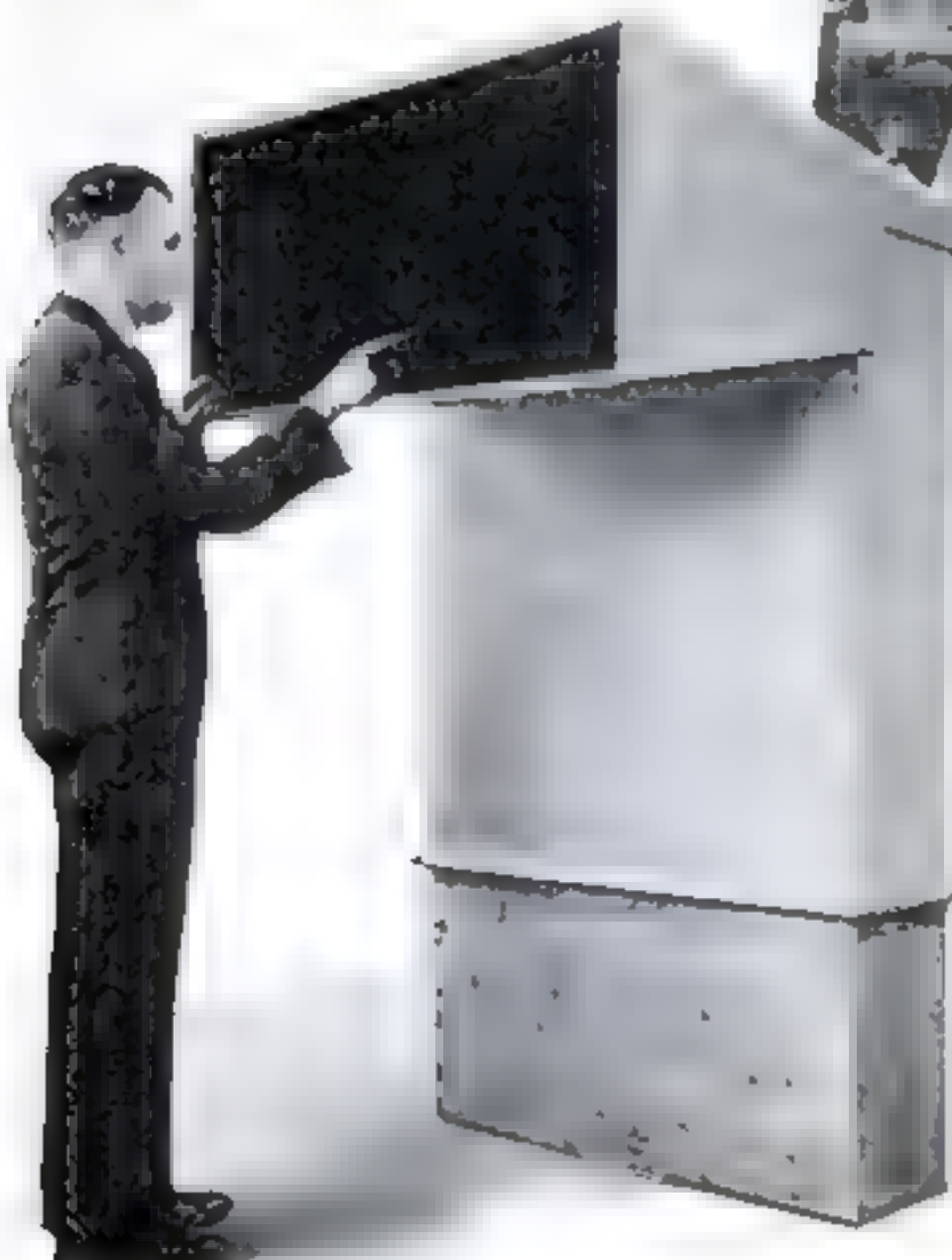
Demonstration of tool for grinding crankshafts. In the view above, arrow points to the tiny grinding wheel driven by a flexible shaft



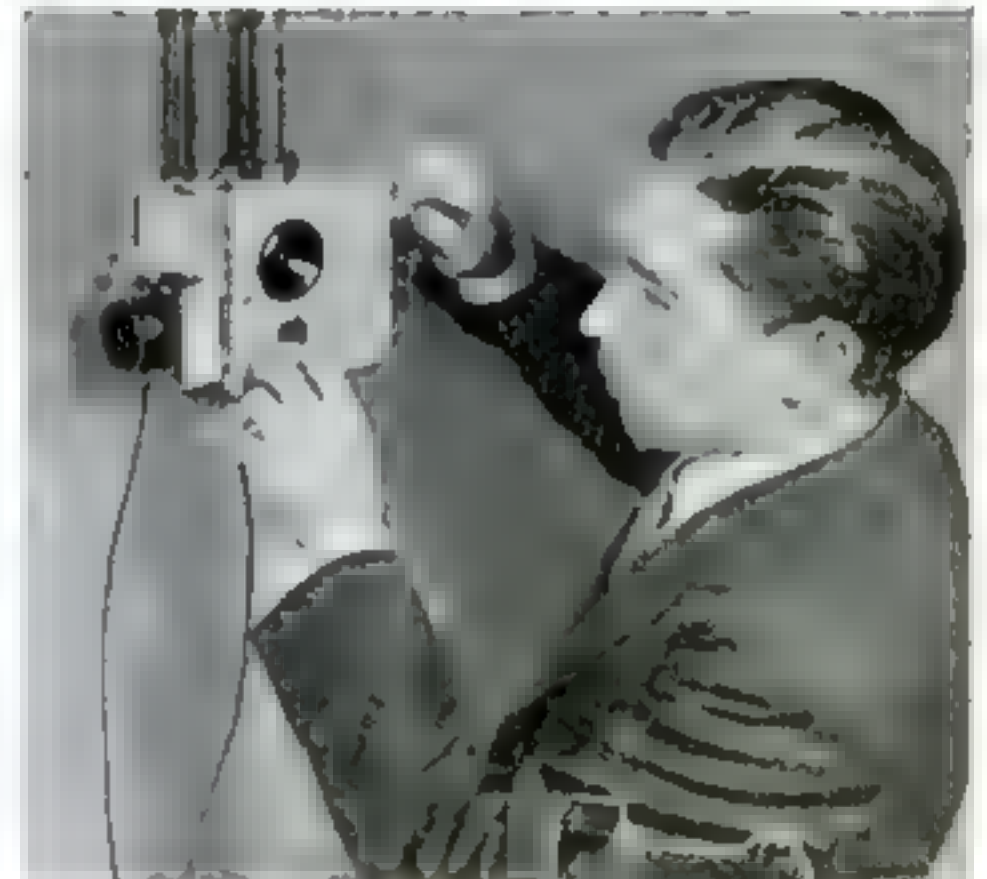
Periscope Lures Patrons to Basement Store



Basement store viewed through the periscope from the ground-floor level as at right. Below, the device before installation



TO ATTRACT attention to a basement salesroom, a Hamilton, Ontario, storekeeper rigged up a novel inverted periscope that enables persons on the sidewalk to view the entire basement department of the store. The device consists of an arrangement of mirrors in a wood and wall-board frame, with the viewing end set in a show window.



This phone needs no outside current supply. At the right is its powerful magnet and signal crank



Voice-Powered Phone Makes Own Electricity

A "VOICE-POWERED" telephone that requires no batteries or other source of electric current has just been perfected by Bell Telephone Laboratories engineers. Light in weight, the new units have cone-shaped diaphragms that serve for transmission and reception. Voice waves striking the transmitting diaphragm generate electric currents which can be transmitted by wire over short distances and then transformed back into sound waves. The novel development is designed for short-distance communications.



Mounted Cops Get Two-Way Radio

RADIO police on horseback were introduced as a feature of this year's Grand National steeplechase in England. Along the course of this classic sporting event, mounted officers were equipped with midget receiving and transmitting sets, keeping them in constant touch with headquarters and patrol cars.

Reflector Serves as Safety Light

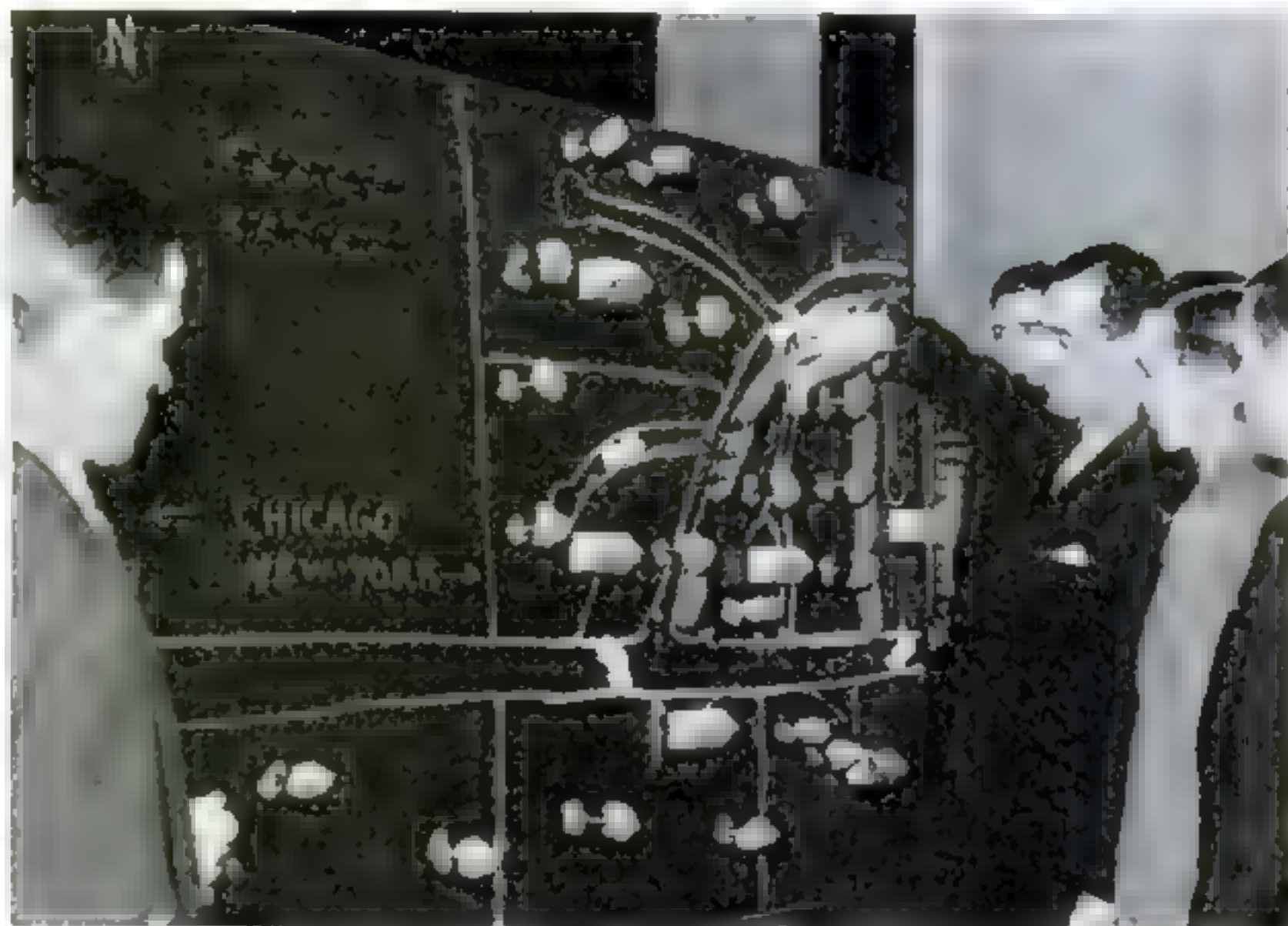
TO SAFEGUARD motorists making roadside repairs at night, glass safety reflectors with folding bases are now available. Placed behind the stalled machine, the reflector gives off a brilliant red gleam when struck by the headlights of an approaching automobile. When not in use, it can be folded and stored in a glove compartment or pocket.



This reflector guards motorists making night repairs

Magnetic Blackboards Aid G-Men

MAGNETIC blackboards now assist Government agents in planning raids and training rookies at the Washington, D.C., headquarters of the Federal Bureau of Investigation. Miniature trees, buildings, and automobiles, with metal bases, are held in place by magnetism.



Agents using model houses, cars, and trees to illustrate a crime problem



Outboard motor in position and, right, the device that enables it to be padlocked

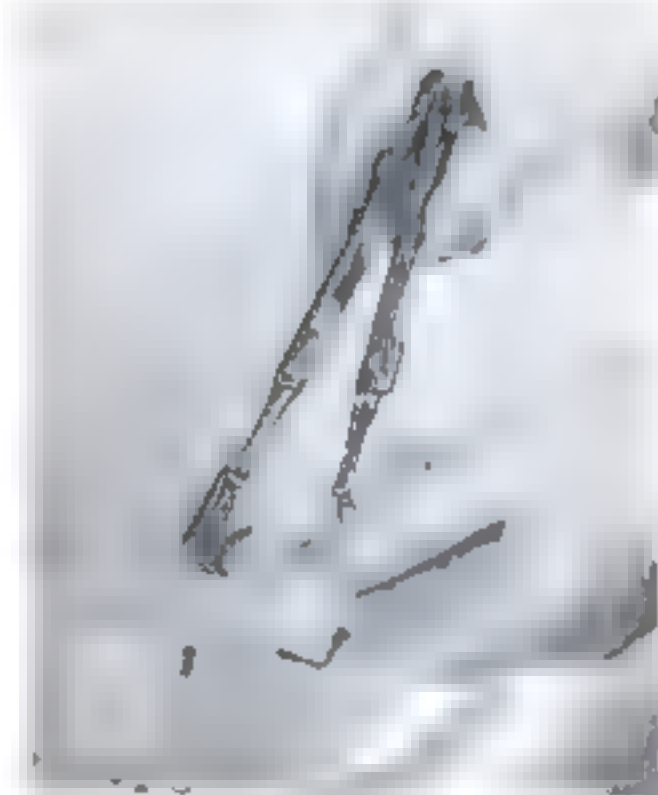
New Lock Guards Outboard Motor

OUTBOARD motors can be guarded against theft by means of a new locking device. When the motor clamps are screwed down, two metal arms attached to the stern of the boat are turned, causing semicircular metal flanges to engage the clamps. The arms can be padlocked in position, securing the motor in place.



Toothbrush Has No Bristles

BLOCKS of sanitary sponge replace the conventional bristles in a new type of toothbrush. According to the manufacturer, the sponge structure produces alternating pressure and suction which makes the cleansing action unusually effective, and at the same time does not scratch the enamel. The handle opens like a pair of tongs for changing the sponge.

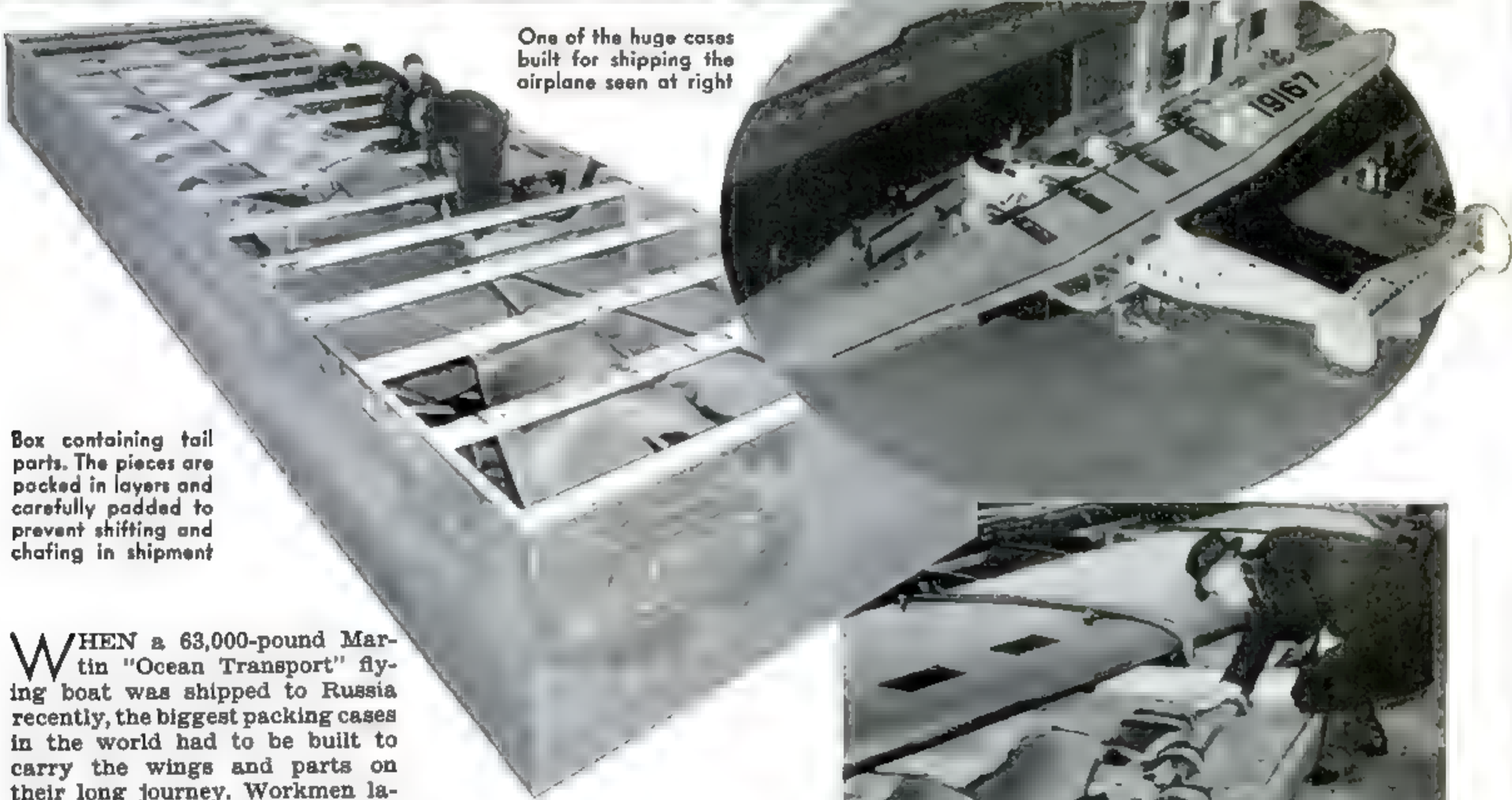


Handle opened to permit changing of the sponge brush block

World's Biggest Packages Hold Giant Transport Plane



One of the huge cases built for shipping the airplane seen at right



Box containing tail parts. The pieces are packed in layers and carefully padded to prevent shifting and chafing in shipment

WHEN a 63,000-pound Martin "Ocean Transport" flying boat was shipped to Russia recently, the biggest packing cases in the world had to be built to carry the wings and parts on their long journey. Workmen labored for weeks putting in padding and strapping the separate parts in place to prevent chafing and scratching. So heavy were some of the timbers used in the protecting cases that a box which held less than half a ton of tail surfaces weighed more than 17,000 pounds. As a final protection,

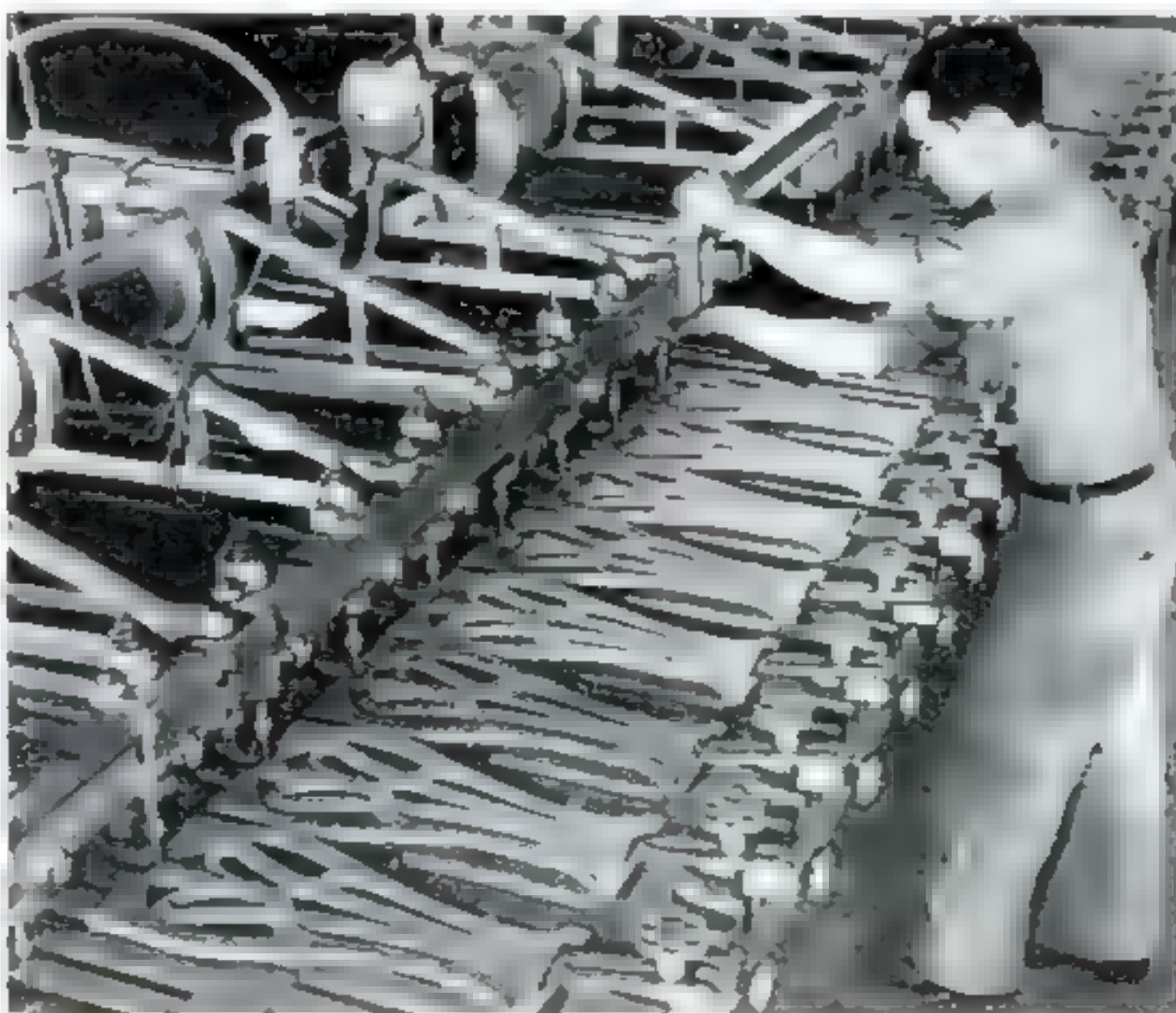
heavy metal bands were placed around each case before it started on its 6,000-mile trip. The wings of the immense flying boat have a spread of 157 feet and the length of the great machine is ninety-six feet. The craft has four engines developing 1,000 horsepower each.



Vertical-fin parts bound to the bottom of a packing case

Device Cuts Fancy Designs in Duplicate

TURNING OUT twenty-four duplicate carvings at a time, a new machine speeds up the production of fancy chairs and other furniture. The part to be reproduced is carved by hand and placed in the machine. Guided by an operator, the battery of automatic carving tools accurately follows the lines of the original pattern.



Operator guiding machine to make twenty-four carvings at once

Midget Photoflash Bulb

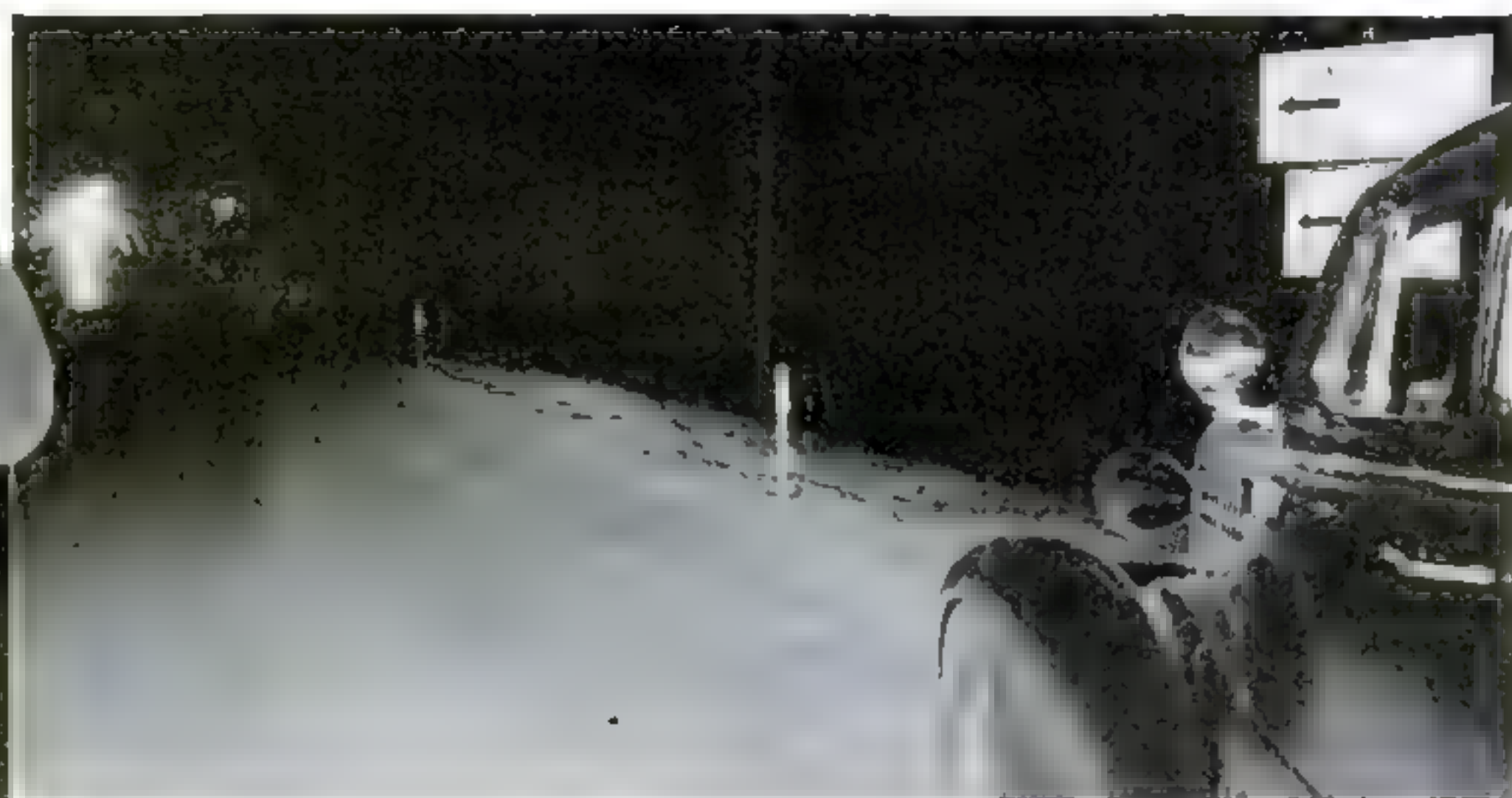
BY USING a combination of metal foil and wire, Westinghouse engineers have produced a photoflash bulb so small that a photographer can carry eighteen in his coat pocket. The new midget bulb is said to produce a longer flash than ordinary types.



Eighteen bulbs can be carried in a pocket

New-Type Reflectors Mark Edges of Highway at Night

One of the new reflecting road markers and, right, a stretch of highway equipped with them. Note how far ahead of a car they outline the course of the road



REFLECTING ten times as much light as materials previously used, a new nonshatterable plastic is being tested for guide markers along unlighted roads. Reflectors made of the new material are placed at 100-foot

intervals along highway shoulders to outline the road as far as one mile ahead of the automobile headlights they reflect. Since the markers entail no operating expense, they may solve the lighting problem on rural roads

Cars Get Make-Up for Movie Appearances

LIKE screen stars, automobiles that appear in moving-picture scenes are now subjected to a novel make-up treatment before going before the camera. Because polished, gleaming surfaces might cast strong rays of reflected light directly into the camera lens, thus spoiling the film, all shiny parts are dulled with a spray coating of paint and reflecting edges are covered with a black adhesive tape.



Tape being applied to shiny surfaces to kill reflection



Martin L. Jackson weighing out an order of lard from his ingenious dispensing machine

Dispenser for Lard Pumps It from Can

DISPENSING lard to purchasers is made easier by an invention of Martin L. Jackson, a Winston-Salem, N. C., storekeeper. The operation of a jack beneath a 110-pound can of lard forces the fat up through a metal spout, while the weight is indicated on a graduated scale.

"Wrist-Watch" Thermometer

RESEMBLING a wrist watch, a novel health thermometer shows whether the body temperature of the wearer is normal. Surface heat of the body acts on a mercury column within the case, raising it above a red warning line to indicate a fever. Worn by children, the device would enable parents to note abnormal temperatures quickly and easily. The unit can be combined with a real wrist watch.



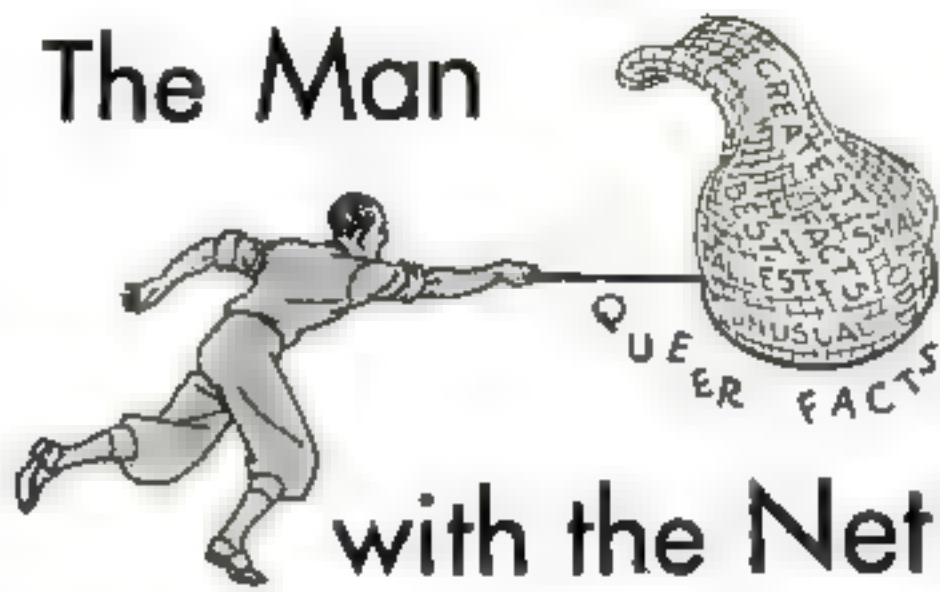
Signpost Shows Air Lanes

RADIATING markers of an odd aviation signpost at the Amsterdam, Netherlands, airport show directions and distances to places reached by scheduled planes of the Dutch air lines. The most remote destination is Batavia, Dutch East Indies, over 9,000 miles away.



Mercury column checks on temperature

The Man



with the Net

HUMAN eyes are twenty-five years old before they are fully developed.

SYNTHETIC perfumes first appeared about 1850.

CIGARETTES that produce colored smoke to match the gowns of women smokers have been invented by a man in Tennessee.

MINSTREL NOTHING,
MY WIFE WEARS
BLACK?



DRUNKEN pedestrians cause more traffic accidents than drunken drivers.

MOLASSES roads are being tested in India. After the sirup is treated and mixed with asphalt and coal tar, it forms a hard surface which is not affected by the heat.

OPOSSUMS have more teeth than any other North American mammal.

TOADSTOOLS get their name neither from toads nor stools. The word is of Germanic origin and means "death sprouts."



HEY, LEAVE ME
SOME CLAIM!
TO FAME!

HARVARD scientists have produced a microscope which makes possible pictures of objects only 100 times larger than an atom.

DISEASE bacteria all have the power of locomotion. A typhoid germ moves about one tenth of an inch an hour, approximately 2,000 times its own length.

COAL furnished eighty-nine percent of the fuel energy in the United States in 1908; today it supplies only half.

CANES with first-aid kits in the handles have been brought out in Hungary.

WHAT DO YOU DO
BEFORE YOU NEED
A CANE?



INSECTS destroy an estimated one tenth of everything man grows.

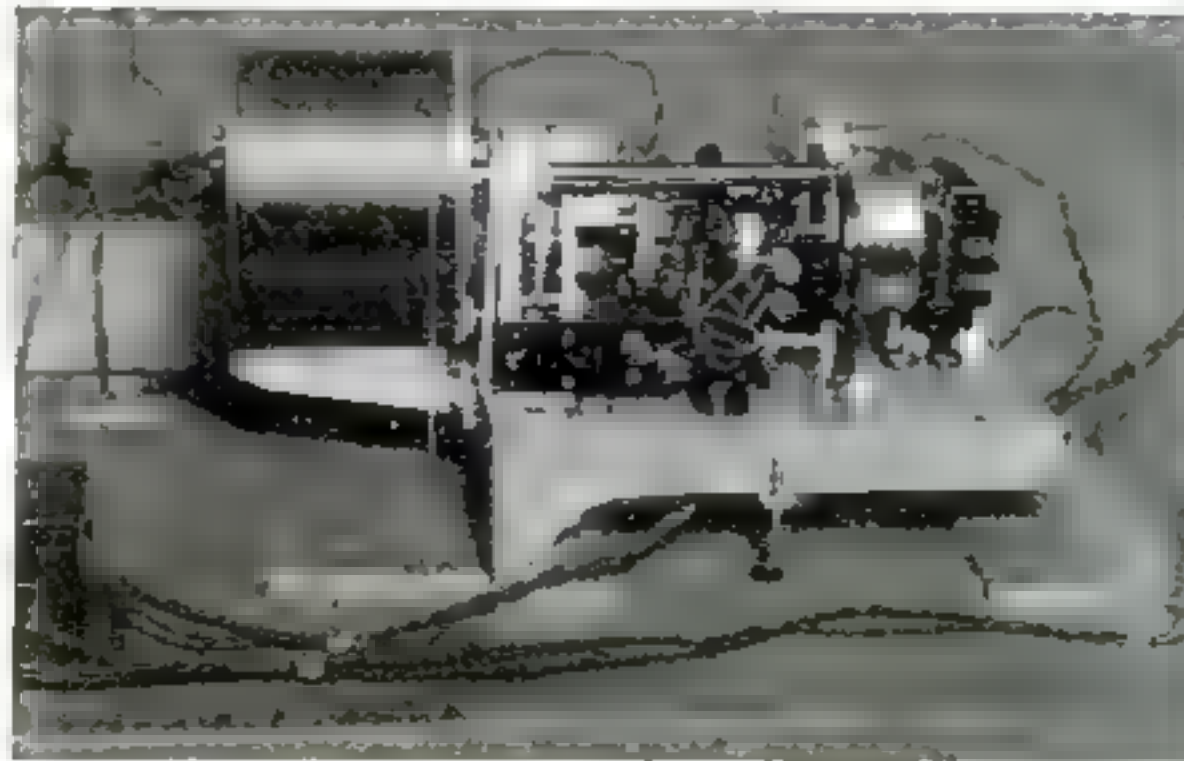
ALDER bushes are being planted in the Swiss Alps to prevent snow avalanches.

SLEEPING sickness attacked 88,000 horses in the United States in 1937.



DON'T I KNOW IT!

Automatic River Gauge Reports by Phone



Signals transmitted by telephone from this automatic mechanism and timed by the distant observer, as below, tell the level of the river

AS AN aid to flood forecasting, Weather Bureau observers can now follow the rise and fall of a near-by river by dialing a telephone number. Automatic, electrically operated gauges at the water's edge are wired to a telephone line. When an observer dials the gauge number, he first hears a gong, followed shortly by two buzzes. By clocking with a stop watch the interval between the buzzes, the exact height of the river can be determined.



Handy Garden-Hose Carton

GARDEN HOSE is now displayed by dealers in protective cardboard containers which permit the contents to be examined by prospective customers without damaging the package. A hand hole in the center of the metal-edged container makes it easy for the purchaser to carry the hose home, as illustrated at the left.



Hose package carried by hand hole

Brush Cleans Suede Shoes

EQUIPPED with triangular-shaped bristles, a new brush is designed especially for cleaning suede shoes. A circular motion of the brush forces the bristles into the nap, bringing dirt to the surface and restoring the material's original luster. Brush bristles are made of rubber.



Car Horns Tested by Portable Meter

WHETHER the sound of an automobile horn is too weak to give adequate warning, or much louder than necessary, is determined by a test unit just developed. Powered by built-in batteries, the device is held about three feet in front of a car. A microphone picks up the sound, whose relative volume is indicated on a calibrated dial. Individual horns are then adjusted to a standard volume.



Sound meter in use for testing sound volume of a car horn



"Streamline" Rider Sets New Motor-Cycle Records

CUTTING his air resistance down to a minimum by lying prone on a motor-cycle saddle with his feet extending straight out behind him, Roland Free,

trick rider from Indianapolis, Ind., recently set two new world's records while piloting standard-model motor cycles over a one-mile course laid out

on the sands of Daytona Beach, Fla. Free is pictured in the photograph above, flashing at top speed past flag markers lining the course.



Radio Waves Run Watch

RADIO impulses operate the watch of intricate design pictured in the photograph above. Designed to run without winding, the radio-powered timepiece, according to its inventor, presages the day when all clocks and watches will be controlled automatically by radio.



Searchlight Has Invisible Beam

Mounted as at left, the spotlight's concentrated rays are aimed by gun sights

RAYs from a novel lighting unit invented by a Dutch Army officer are concentrated into a narrow beam that eliminates practically all reflection and is invisible, except to those directly in its path. Designed for use during night air raids, the units will be built into pistollike housings for use in signaling, as well as mounted on vehicles as headlights.



How the headlights are fitted to a military car

Rotary Shovel Speeds Handling of Dirt

ADJUSTABLE in height and working angle, a new electric power shovel has revolving scoops at one end of its cylindrical barrel that dig into the soil. Carried along within the barrel by a

belt conveyor, the soil is dumped from the opposite end into a waiting truck, either directly or by means of a second belt conveyor. The shovel is seen at work in the photograph below.



Revolving scoops dig up soil and a belt conveyor drives it to the other end of the unit, as at left

New Aids for Camera Fans

Tripod Head Helps Make Odd-Angle Shots



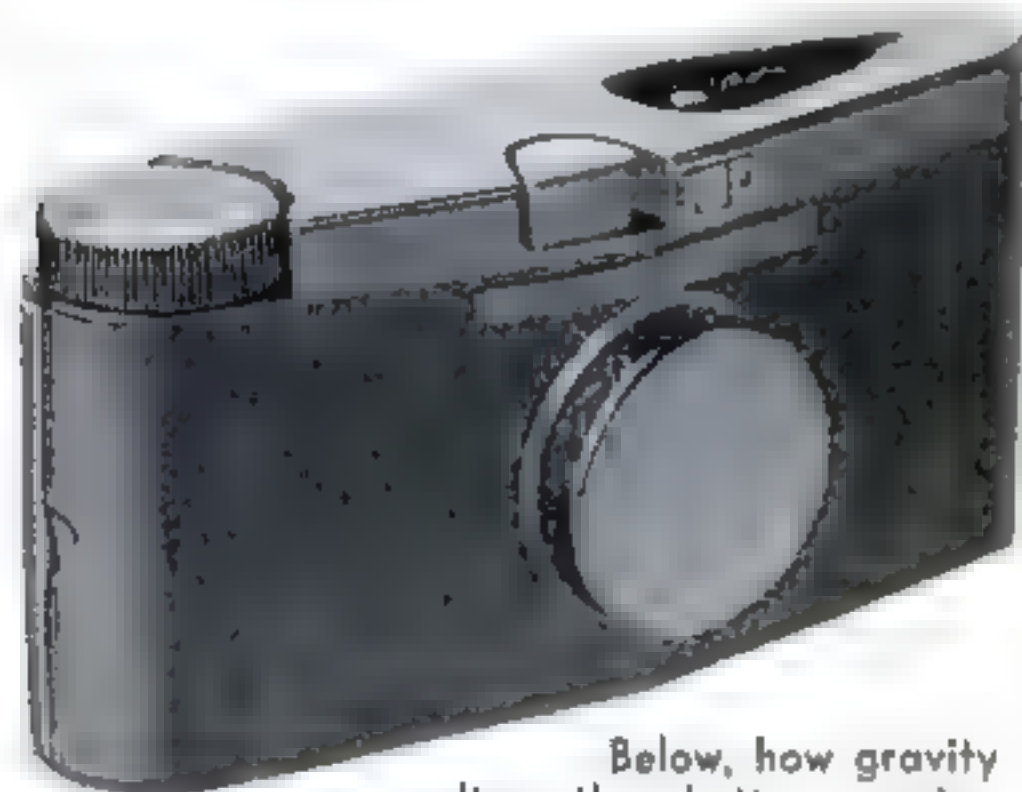
Ring-shaped mount used for steadying a camera by hand and, right, on a tripod

ODD-ANGLE shots are simplified by an ingenious new tripod head consisting of a steel ring with a slot extending halfway around it. A thumbscrew, inserted in this slot, attaches the ring to the tripod and another thumbscrew holds the camera to the ring. By turning the ring and twisting the camera, any desired angle can be obtained. Without a tripod, the ring can be used for steadying light cameras.



Twin-Solution Developer Gives Quick Results

HIGH-SPEED development for films and enlarging paper is a feature of a new two-solution developer sold in powder form. In ninety seconds, according to the manufacturer, films treated with the chemicals are completely developed. The powders are mixed with water to form two solutions. Films and paper are immersed first in one fluid and then in the other.



Below, how gravity alters the shutter opening



Shutter Speed Is Fixed by Tilting Camera

MERELY by tilting a new British-made camera, the user can set the focal-plane shutter to record fast, slow, or medium action. A gravity-operated cam makes the adjustments automatically, increasing or decreasing the size of the shutter opening as required. Held horizontally, the camera records a snapshot with an exposure of 1/150 second. Vertically, with the film-winding knob down, it gives 1/25 second; held with the knob up, 1/450 second. The new outfit has a fixed-focus lens.

Tiny Exposure Meter Is Worn on Wrist

A "WRIST-WATCH" exposure meter which leaves both hands free for operating the camera is now available to photographic fans. Hardly larger than a cigarette lighter, the meter is said to be sufficiently sensitive to measure light so dim that a half-minute exposure at F/11 with normal film would be required to get a picture. Exposures can be read directly from the dial, eliminating the necessity of reference tables.



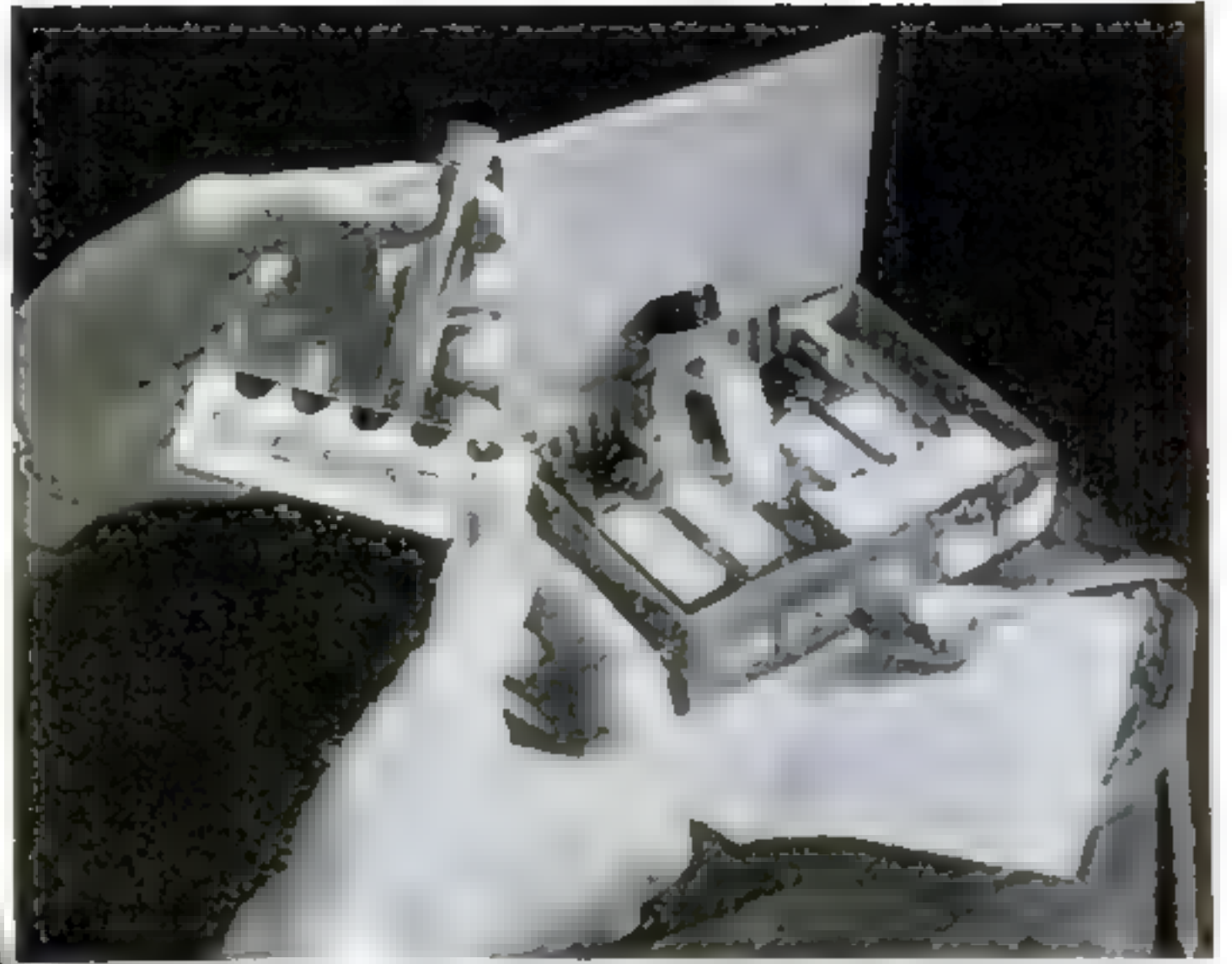
Strapped onto the wrist, this light meter leaves both hands free for operating the camera

Handy Test Chart Gives Check on Equipment



Chart being photographed to test lens, focus, and filter

USING an involved pattern of circles, diamonds, squares, stars, and wavy lines, a new camera test chart gives the amateur photographer a simple way of checking up on his equipment. Unfolded and hung on the wall, the chart is fifteen by twenty inches. After it has been photographed, the manufacturer explains, study of the resulting negatives and prints will show whether the lens is faulty, whether the camera focuses accurately, and whether correct filters were used.



TESTING FOR PHOSPHORUS. With the small soil-analysis outfits, tests are made by shaking soil in prepared solutions and matching the color reactions against transparent color samples. In the photograph at the left, one of the more elaborate kits is in use in the garden



This is how the phosphorus content of the soil is determined with the outfit at top. Reagents are measured in drops, to make it easy for amateurs

How Good Is

SOIL-TESTING KITS POINT

By **ARTHUR
HAWTHORNE CARHART**

WITH faces painted, their bodies almost naked, members of the Snake Clan of the Hopi Indians dance with live rattlesnakes between their teeth to insure good crops. Near little *placitas* that are remnants of Colonial New Spain, plowmen carry the image of a saint with them as they cultivate the soil so that harvests may be bountiful. But the modern gardener, amateur or professional, can look in a test tube to learn the secrets of his soil and know what he must do to make his fields, flower plots, and vegetable beds produce flower, fruit, and foliage. Science has brought the chemical laboratory into every garden.

In past years man wrestled blindly with the hidden processes at work in field and garden. A half century ago, few people thought of soil particles as tiny natural laboratories where changes

always are taking place. Mineral values of soils were a mystery. The hordes of beneficent or malignant bacteria in cultivated fields were unknown. The farmer or gardener knew the soil was "good" or "poor," and by cut-and-try methods learned to lime, mulch, and fertilize to make land more productive. Often his guesses as to what should be applied to a soil to increase its fertility were wrong. If the crop failed, he changed methods next season. Again he might be wrong. It was a slow, costly business.

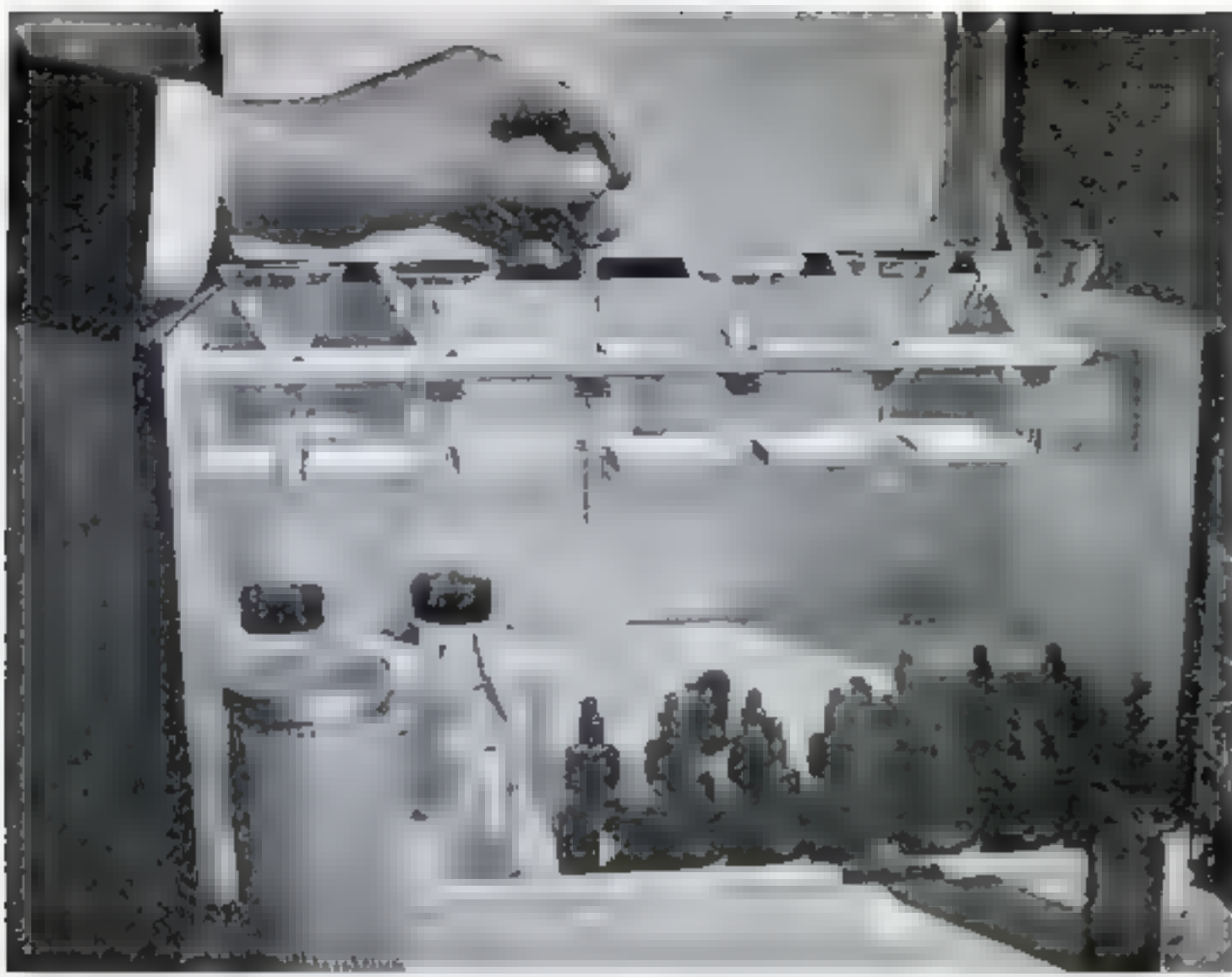
Then the chemistry of soils developed in finely equipped laboratories at state experiment stations. A wealth of scientific data concerning crops and their plant-food requirements was gathered. Still, no home owner could hope to set up his own laboratory to test soils in his own back yard. Even if he was technically trained, his pocketbook forbade the purchase of expensive equipment required.

Now it is feasible for every home gardener, farmer, florist, and vegetable grower to know the important facts concerning the chemical content of his tilled ground. A half dozen companies are offering soil-testing kits so simple, so inexpensive, that anyone may check the productive qualities of his garden's earth. The old by-guess-and-by-gosh program of fertilizing soil is as out of fashion as hoop skirts. Appealing to snake gods and saints has been made obsolete by modern science.

The principal chemicals needed in a soil to make it productive are nitrogen,

phosphorus, potassium, calcium, magnesium, aluminum, manganese, iron, and sulphur. Of these, the most important are nitrogen, phosphorus, and potassium. Nitrogen is the plant food that produces green growth. If it is too abundantly present the plants may "run to top" without properly developing fruit and flower. Phosphorus and potassium, the other primary plant foods, stimulate fruit, root, and flower growth. In the majority of soils, if these three are present in adequate amounts, there will be sufficient quantities of other mineral foods to make a crop.

On every bag of commercial fertilizer there usually is a series of numbers; for instance, 5-8-7. This number series would mean that the prepared fertilizer contains five percent of nitrogen, eight percent of phosphorus and seven percent of potash (potassium carbonate). The bulk of the material in a prepared fertilizer is generally peat, loam, sand, or other "carrying" medium. The average commercial fertilizer is a sort of estimated gunshot application of nutrient values to the soil. Without knowledge of what already is in the soil, a routine application of such fertilizer may put some chemical into the soil that is present in sufficient quantity, and not supply enough of another plant food to keep a proper balance in nutrient values. A test of the soil that shows the presence or lack of these available plant foods is a positive guide by which the gardener can purchase only those chemicals that should be added to bring the soil into a balance.



PORTABLE FIELD LABORATORY. Equipped with glass funnels, filter paper, pipettes, and numbered bottles of reagents, this complete kit will determine the amounts of even the less vital nutrient soil elements. At the right, a sample of soil is being sifted and mixed in preparation for testing



Your Garden?

THE WAY TO BETTER YIELDS

Furthermore, if no commercial fertilizer is found to fit the needs of the soil, one may mix his own, buying the separate chemicals that carry the plant foods in available form, and combining them, in a sort of tailor-made fertilizer to exactly suit the individual garden's needs.

Soil tests determine another fundamental fact in relation to growing conditions—whether the earth is acid or alkaline. This is as important as knowing the amount and balance of chemical plant foods in the garden. Different plants require different degrees of acidity or alkalinity. A rhododendron, for example, planted in a soil slightly alkaline, is doomed. Asparagus, however, will die if the soil is not alkaline. It is vitally important to know the acid-alkaline qualities of a soil, and this is the first test the home gardener makes with his testing kit.

THERE is nothing technical about the soil-testing kits now offered on the market. There are no chemical formulas to remember, no exactly calibrated apparatus to manipulate. Anyone able to read average newspaper English and tell the difference between light blue and dark blue, or light orange and dark, can make the tests.

The simplest kit is so small it can be carried in a coat pocket. It costs two dollars and has sufficient solutions and all equipment necessary to make five complete tests of acidity-alkalinity, nitrogen, phosphorus, and potassium. Anyone who can pour dirt from a teaspoon into a glass tube, and solutions

out of a small bottle, can operate it. This is the kit for the average home grounds. While it does not check on manganese, iron, and other nutrients of secondary importance, it does give positive results in testing for the four most important factors.

More elaborate kits range in price from seven or eight dollars to thirty and up. At thirty dollars there is a field kit weighing seventeen pounds, fully equipped, that will determine the amounts of calcium, magnesium, aluminum, manganese, iron, and sulphate sulphur in a soil in addition to the four primary tests.

From the little pocket kit no larger than a surveyor's field book, to this compact and inclusive field laboratory in the larger outfit, every test is marked by extreme simplicity.

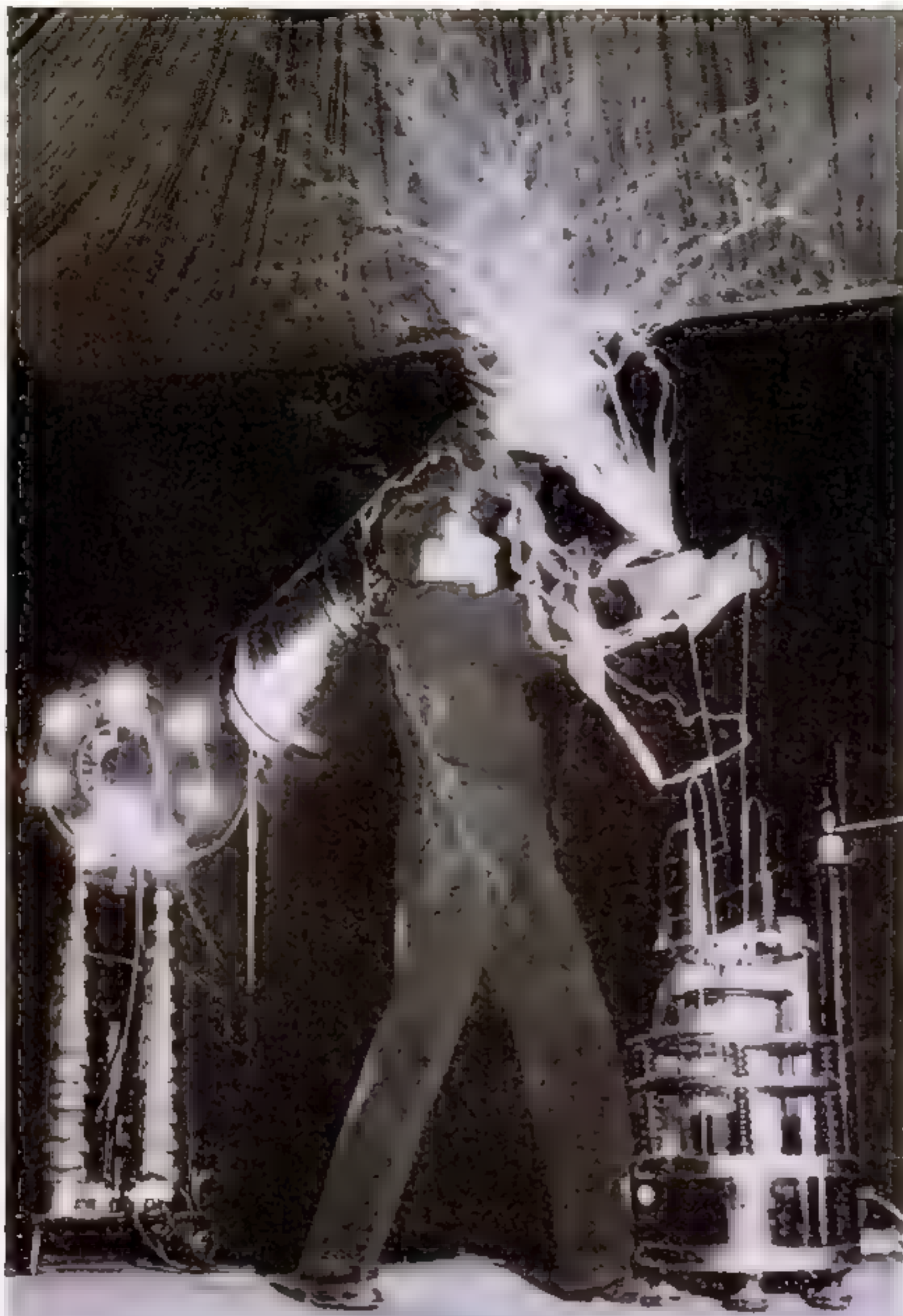
Let's run through a test with the pocket kit. You scoop up a sample of dirt with an ordinary teaspoon. It may be a composite sample, a mixture of soil from all over the home grounds, or from some specific spot. One of the four test tubes in the kit is filled one-fourth full of soil. The cork on each tube is enameled a different color so the same tube will be used each time for the same test.

The solution for the test is poured in on top of the soil until the tube is half full. Then it is shaken thoroughly. At the end of several hours the soil has settled. The solution above the soil is colored. There are four pieces of cardboard in this kit, each with colored



ACID OR ALKALINE? In the simplest of the tests for this important soil property, a reagent is applied to a sample on a prepared test paper and the resulting color is compared with a chart

tabs of transparent material inset on the edges. If you are testing for phosphorus you pick up the phosphorus color chart, matching the color of the liquid in the tube with one of the color insets. Each of the five colors on the cardboard is marked by a letter. If, for example, the tint of the liquid matches the color inset designated as "C," reference to the pamphlet with the kit will show that this soil needs a fertilizer that is twenty percent phosphorus. That is the percentage of available phosphorus in "superphosphate" chemical fertilizer. Knowing your deficiency in this plant food, you have the answer as to what must be put on to bring the nutrient values of *(Continued on page 103)*



Kenneth Strickfaden, electrical wizard, playing with high-frequency current. Humans can stand thousands of volts of this type of current

IN THE death chamber of a state penitentiary, a somber physician draws himself erect. He has just applied his stethoscope to an inert form slumped in the electric chair. He listens for the faintest flutter of life. In solemn tones, he announces that the decree of the courts, death by electrocution, has been carried out.

Hundreds of times, that scene has been reenacted. Not once, in the forty-eight years that electrocution has been a legal death penalty, has any such physician startled an already jittery audience with the announcement that the state had failed in its effort. As a matter of routine, the body is always wheeled into a near-by room for an immediate autopsy. When that is completed, there is no doubt about the death of the condemned man.

But there is serious scientific skepticism arising as to whether victims of the electric chair are always put to death in the manner prescribed by law. Recent research suggests they may only be shocked into a semblance of death

and that the final spark of life is extinguished unwittingly in the autopsy room.

In Boston, Mass., Dr. Leo Alexander, working under the auspices of Harvard University Medical School and Bos-

By
**ROBERT
E.
MARTIN**

A German scientist passing electricity through a subject's body to determine its effect on human nerves and tissues

ELECTRIC

High-Voltage Tests

ton City Hospital, recently concluded a long series of experiments seeking to discover exactly what occurs within the human system when it is struck by man-made lightning. At the Bell Telephone Laboratories, in New York City, Dr. Livingston Ferris is busy with similar tests. At Johns Hopkins University, Baltimore, Md., Dr. W. B. Kouwenhoven has reported interesting discoveries. Human subjects, undergoing mild shocks in a laboratory "electric chair" in Berlin, Germany, have also added to our knowledge in this field of research. Both here and abroad, scientists are tackling the mysteries and problems of electric shock.

The sum total of their discoveries not only throws light upon the effectiveness of the electric chair but also suggests the possibility of saving the lives of hundreds of persons who are killed each year by accidental shocks.

High-voltage currents, Dr. Alexander finds, almost never kill the victim outright. Death occurs after a lapse of time much greater than physicians have believed in the past. Nerve centers are paralyzed, and death results from suffocation when respiration is not maintained artificially. Unless rigor mortis sets in, the Harvard experimenter maintains, no shock victim should be pronounced dead unless he has had at least twelve hours of artificial respiration.

More than 1,000 guinea pigs and 500 sheep, as well as dogs, cats, pigs, and calves, were used by Dr. Livingston Ferris in the experiments he conducted at his New York laboratory. His researches show that high-voltage shocks and low-voltage shocks produce entirely different effects. The former paralyzes the nerve centers, and breathing stops. The latter affects the heart, causing what is known as "ventricular fibrillation." In simple terms, it produces "anarchy" in the heart muscles. Instead of contracting and relaxing in unison, the different muscle fibers begin to flutter independently, and organized pulsations cease. Unless this tendency can be halted, death occurs within a few minutes.

To see exactly what takes place in the heart as the electricity reaches it, one European ex-



SHOCKS ... Do They Really Kill?

Challenge Long-Established Beliefs About Electrocution

perimeter, Dr. R. W. Urquhart, performed delicate surgical operations and placed glass windows in the chests of cats and dogs. Through them, he studied every tiny alteration in the functioning of the organ as currents of various voltages passed through the bodies of the animals.

The only thing that will stop the heart flutter, strangely enough, is a second and stronger shock! Dr. Kouwenhoven reports that counter shocks of the kind, if administered quickly enough, will start regular pulsations again. A current of one ampere, approximately enough flow of electricity to light a 100-watt lamp, has produced this miracle of life-saving.

As a by-product of this research, the discovery has been made that electric current helps the system to recover from other forms of nervous shock. Already, mild currents have proved beneficial to victims in stabbing cases. Dr. Kouwenhoven believes that similar treatment might aid those suffering from nervous shock after traffic accidents.

But for those who have received a high-voltage shock, such treatment is of no avail. Only artificial respiration, keeping the lungs in action, can be of value. In a number of cases, such first-

aid treatment has been prolonged until it "brought to life" men who have received accidental shocks of far greater voltage than those given condemned criminals.

Near Lorain, Ohio, last spring, a despondent young man climbed to the top of a high-tension electric transmission tower, intending to leap to his death. Just before he jumped, he came into contact with a live wire. Thirty-three thousand volts—fifteen times the voltage used with the electric chair—passed through his body like a bolt of lightning. He was knocked thirty feet to the ground. Yet, in spite of shock and fall, he was revived, little the worse for his amazing experience.

Only a few weeks later, an X-ray technician at Bellevue Hospital, in New York City, accidentally touched a live plate and was gripped by a current of 75,000 volts. An assistant switched off the electricity and the unconscious man was rushed to a respirator. In the "iron lung," his body was kept supplied with oxygen automatically until nerve centers revived.

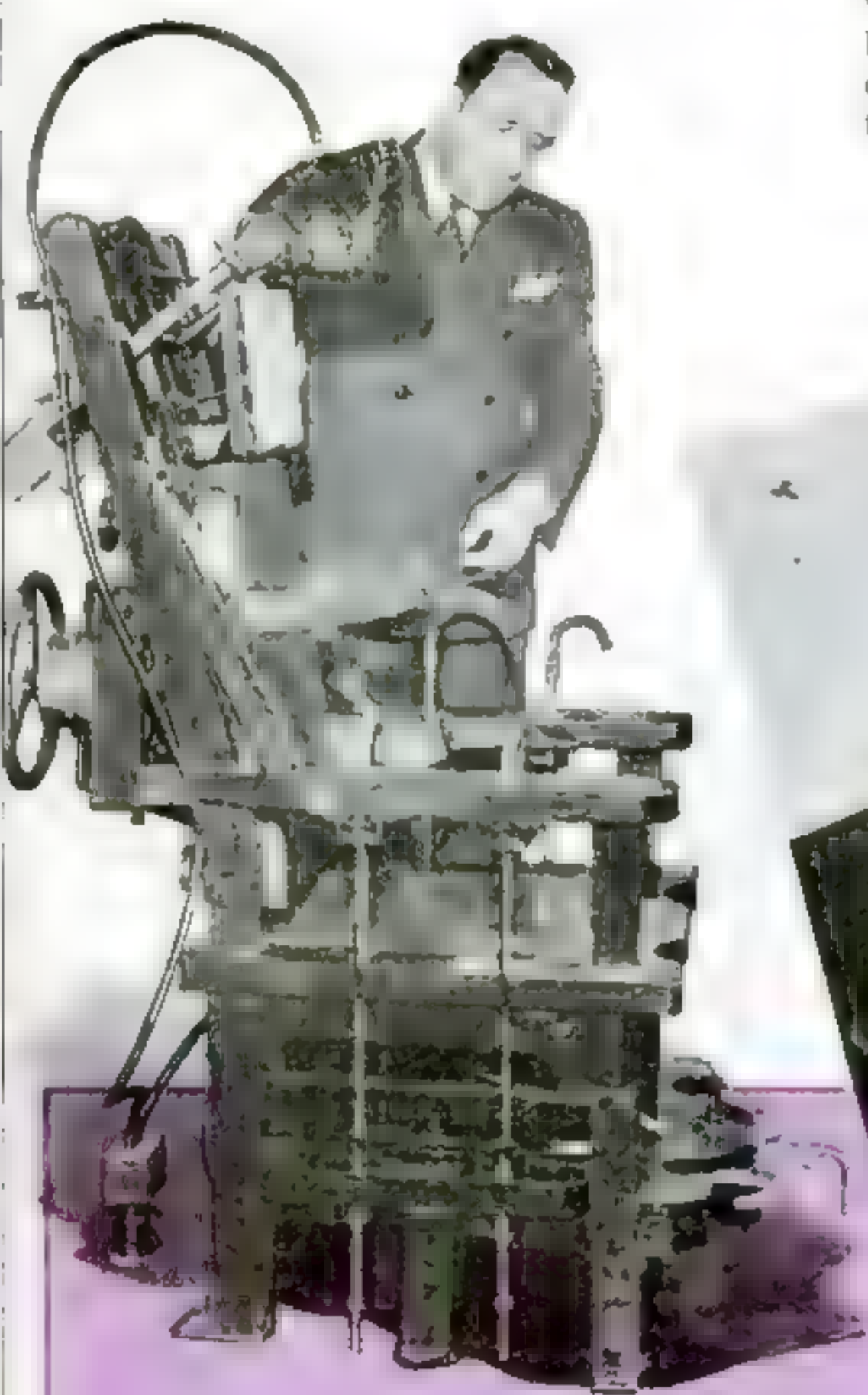
Usually, in such instances, the current has high voltage but low amperage. The volt is a measure of electrical force; the ampere of flow or quantity.

Electric chairs are supplied with current of approximately 2,200 volts and from twenty to thirty amperes.

When Ernest Heglund touched a live wire in a New York power house, not long ago, the current that shot through his body had a voltage of between 55,000 and 70,000 and an amperage between forty and seventy. In every way, it was a bigger shock than ever strikes a criminal in an electric chair. His heart had stopped when fellow-workers cut off the power. Yet, prolonged medical treatment resuscitated him. The spark of life remained, in spite of the appearance of death.

Does it also remain when executed criminals are wheeled into the autopsy room? Could such victims of electric shock be brought to life if given immediate treatment?

No one can answer those questions with finality (Continued on page 141)

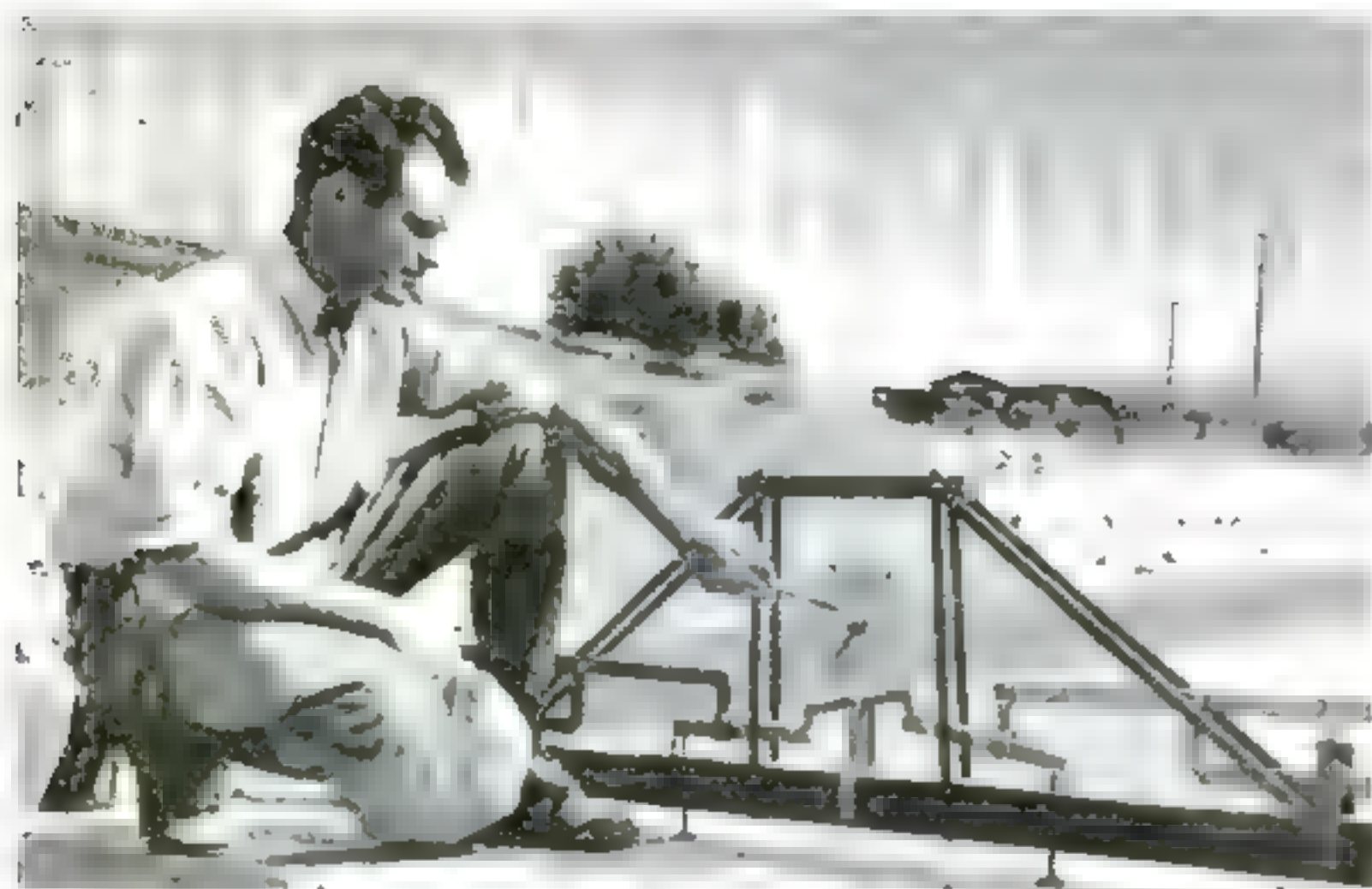


Does the electric chair really kill? Scientific tests raise some doubt. They show that high-voltage currents seldom kill outright



This is an "electric bed" used in experiments being carried on to find ways for reducing the toll of death from accidental shocks

Device Estimates Concrete Needed for Road

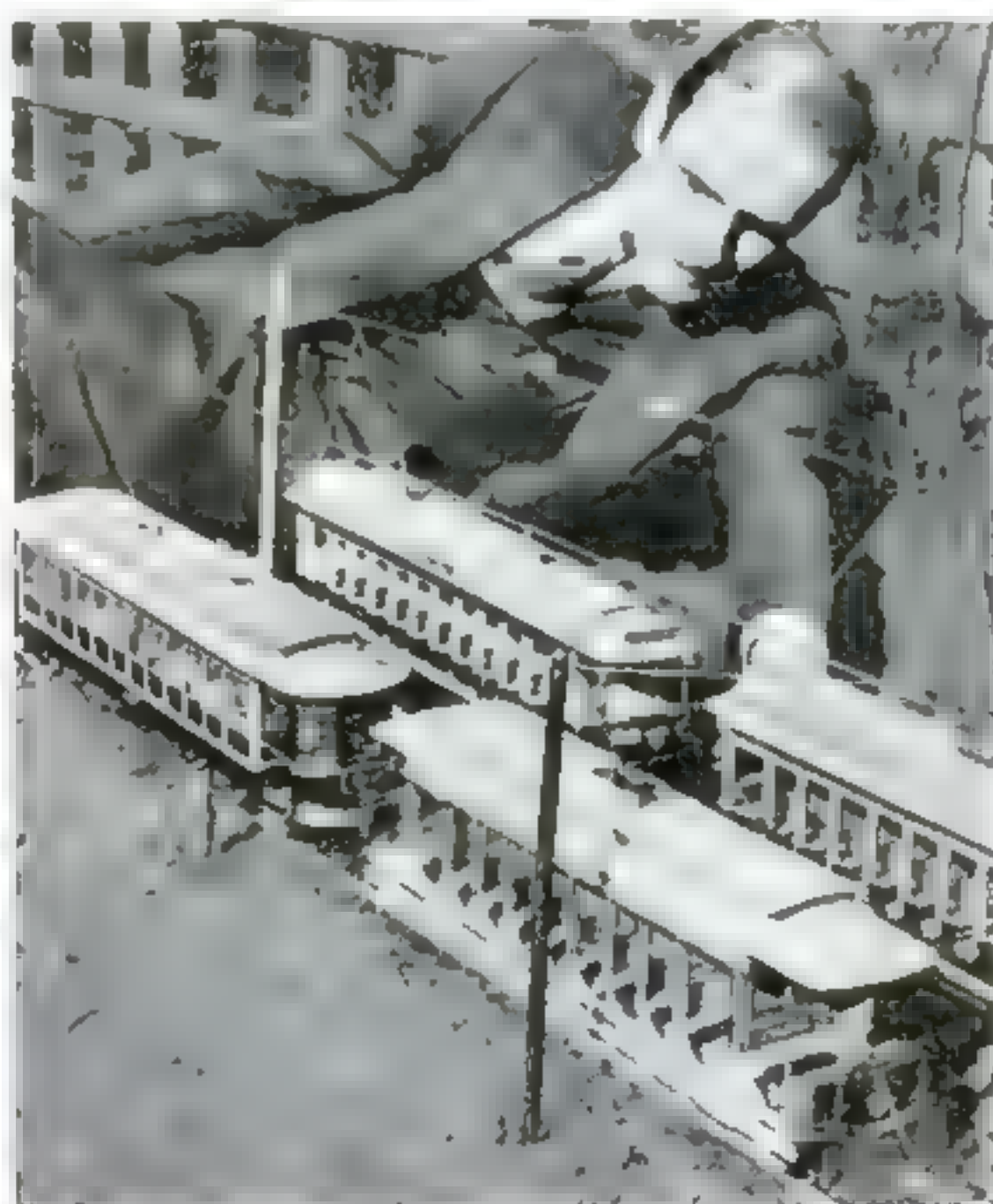


Laid across a road, this unit gauges the volume of concrete for paving

WHEN estimating the volume of concrete required for the surfacing of new highways, engineers and contractors now can save time and eliminate guesswork by making use of a new device that automatically registers the desired information on a dial. Invented by C. N. Wilczek, young California engineer, the portable unit computes the volumes for twenty-five-foot lengths of pavement. It can operate on rough surfaces.

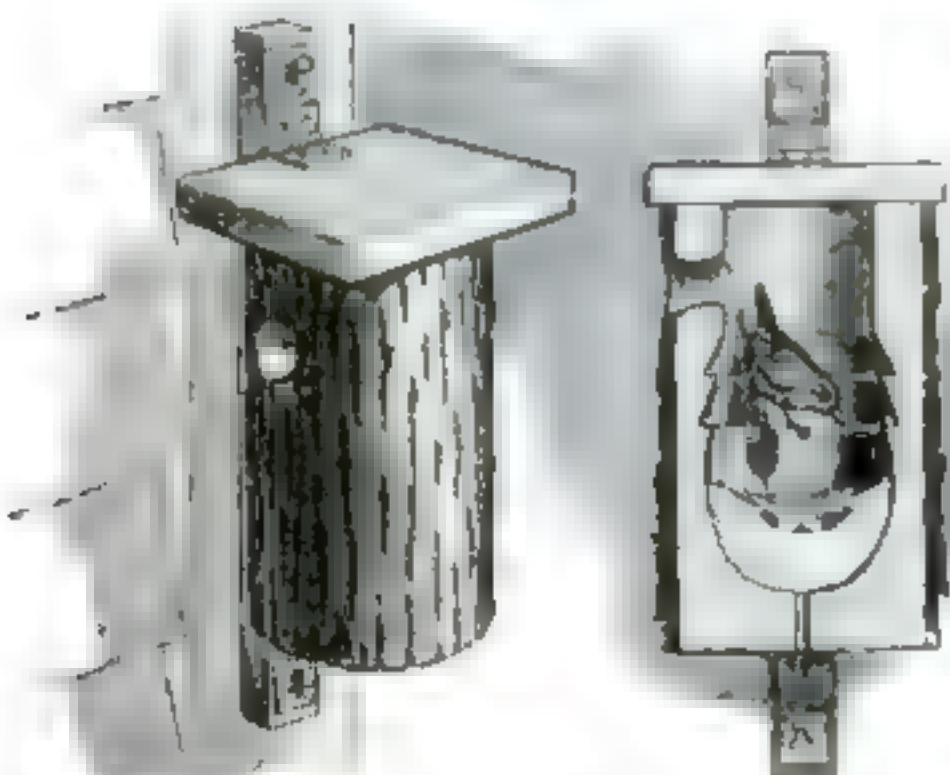
Model Trolley Cars Run on Garden Transit Line

BUILDING and operating model trolley cars is the unusual hobby of Robert Graham, of Brooklyn, N. Y. His collection includes accurate scale reproductions of many types of cars, both modern and old-fashioned, which he runs on track systems laid out in the cellar and garden of his home.



Robert Graham with some of the rolling stock of the miniature trolley system laid out in his back yard

Hollow-Tree Bird House



Bird house patterned after woodpecker nest

PATTERNED after the nest holes that woodpeckers make in dead trees, a new-type bird house is said to be specially attractive to small birds. An entrance hole leads to a room cavity bored out of the center of a section of well-weathered log.

Grade-Crossing Signal Sounds on Car Radio

BROADCASTING a loud alarm signal that cuts through the ordinary radio programs picked up by automobile receivers, an ingenious grade-crossing warning device invented by two Illinois engineers is set in operation by an approaching train. The transmitter has an antenna paralleling the highway for a quarter mile on each side of the crossing. A special attachment enables any car radio to pick up the signals, and a light flashes if the radio is not on.



Radio grade-crossing signal being tested. Note the antenna strung parallel to the road

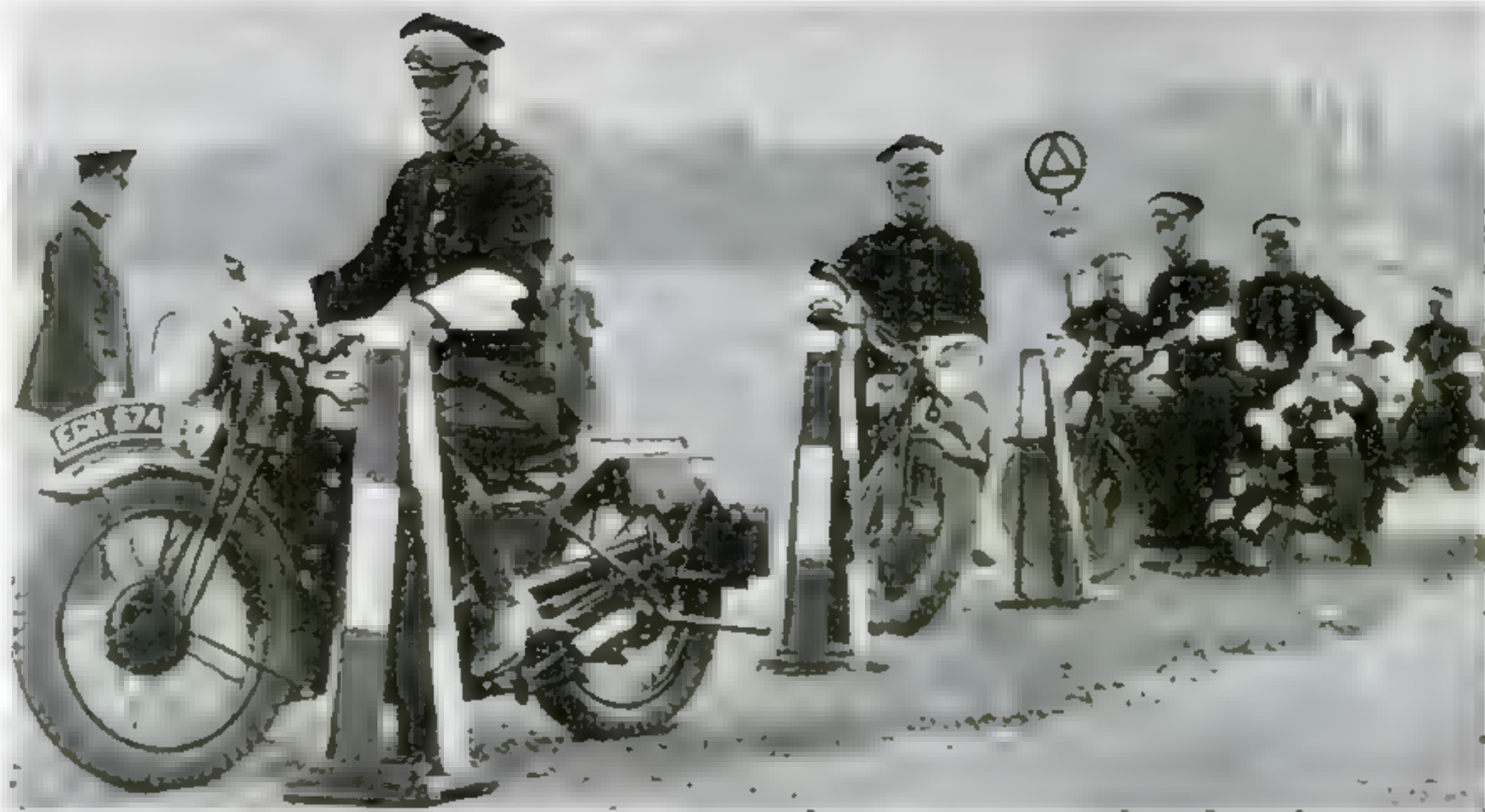


Dairy Leg Guards

LEG guards consisting of two strong slats with convenient straps, as pictured above, have been devised by a Massachusetts inventor to protect milkmaids from injury if Bossy starts kicking at milking time.

Obstacle Ride Trains Rookie Motor Cops

RECRUITS for the London, England, police force learning the ins and outs of their future jobs as motor-cycle patrolmen are put through a period of intensive training, one phase of which is pictured in the photograph at the right. On a field near London, the rookies are shown weaving their machines between painted wooden pylons to accustom themselves to handling their motor cycles at slow speeds in a heavy stream of traffic.



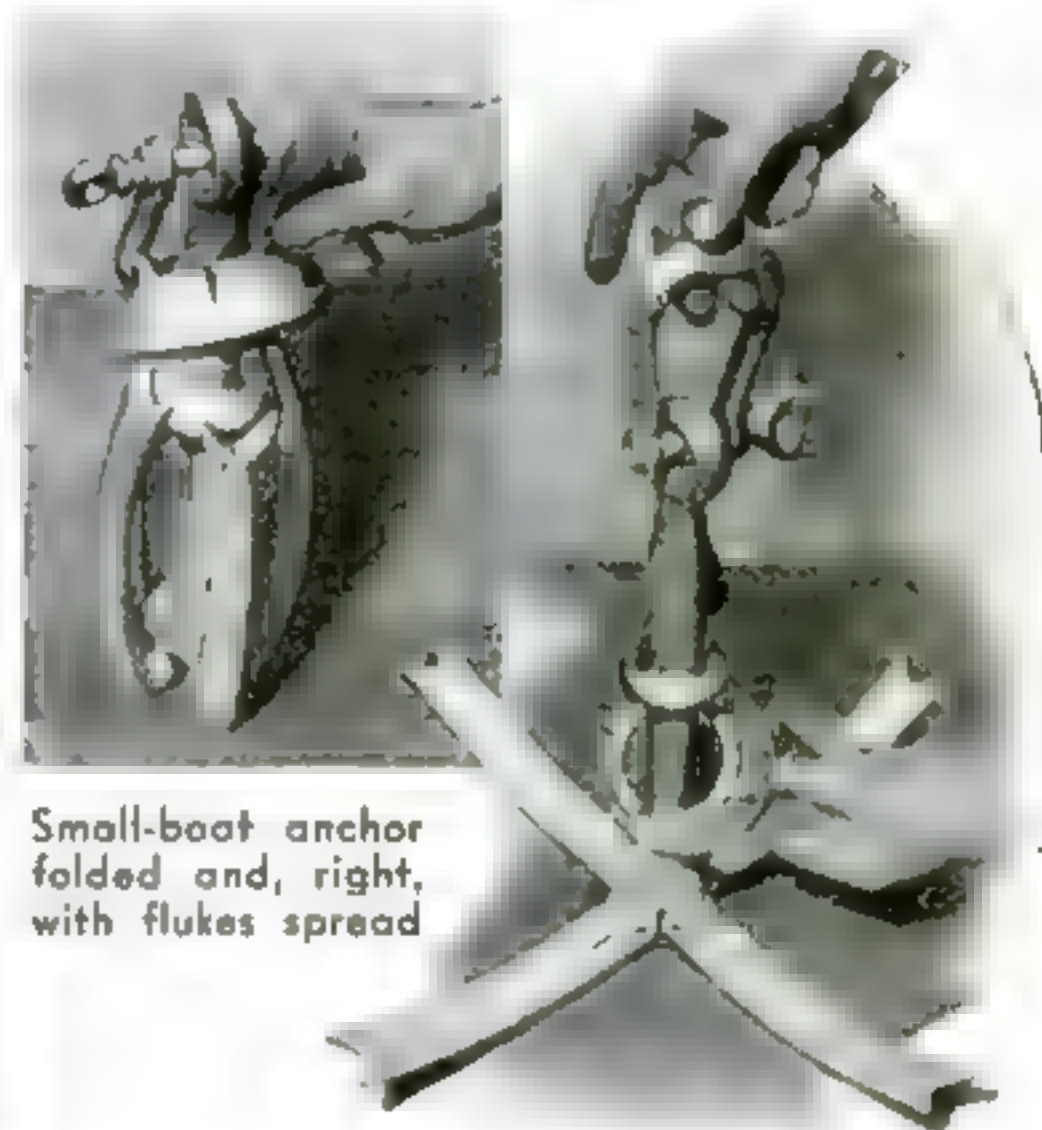
Weaving in and out among these wooden pylons, London motor-cycle police learn to ride in dense city traffic

License Plates Foil Bike Thieves

LICENSE PLATES for bicycles are being tried in several Massachusetts towns, as a method of combating sneak thieves who steal parked wheels. Attached to the handlebars, the bike license has an upper section detachable from the lower. When a rider leaves his wheel, he takes the upper license section with him as proof of ownership, knowing that police will halt the rider of any bicycle that does not display both halves of the license plate.



License plate in place. When the rider parks his wheel he removes the top part, as seen at the left



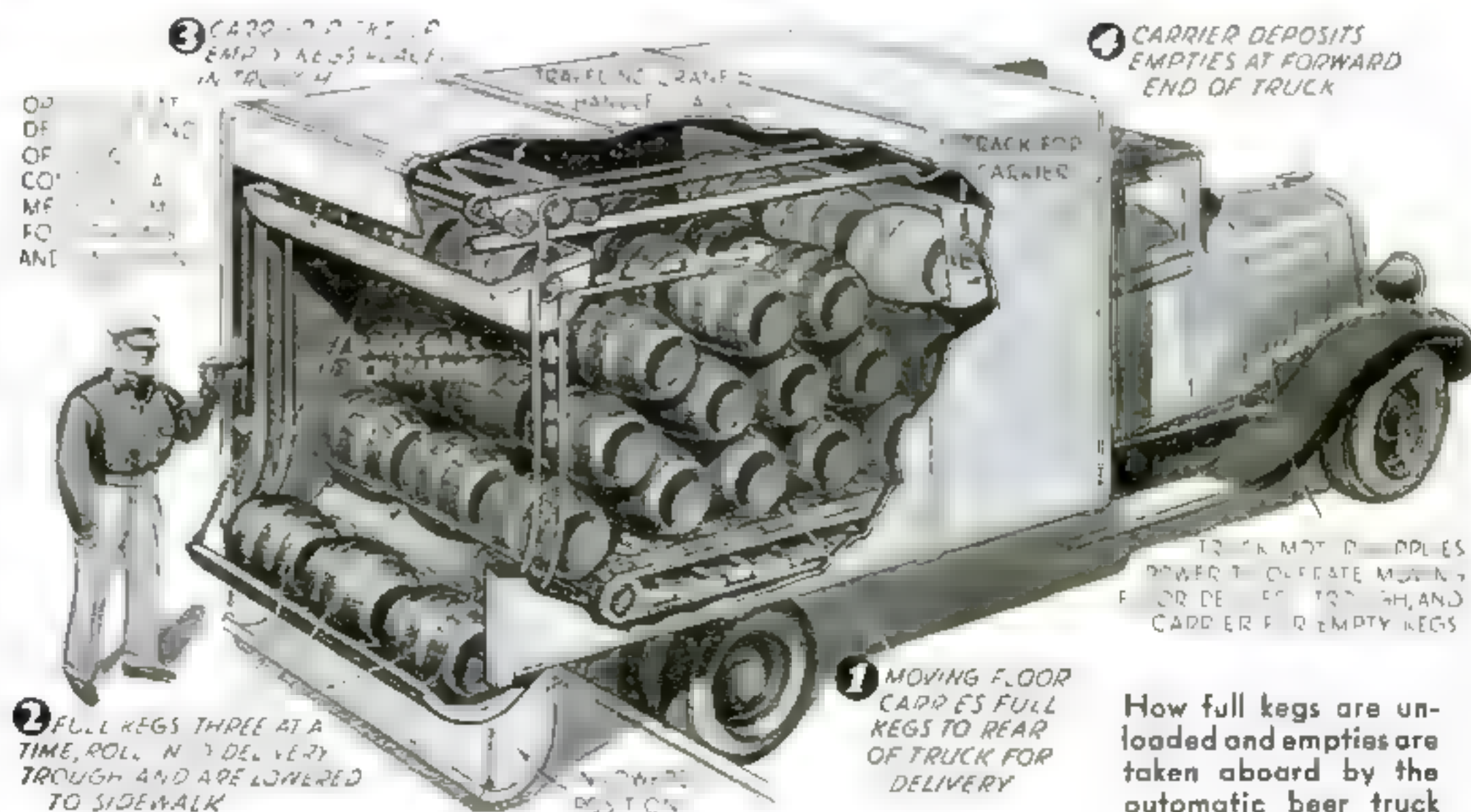
Small-boat anchor folded and, right, with flukes spread

Boat Anchor Folds Up

TO CONSERVE space aboard small sailboats and cruisers, a compact anchor now available folds when not in use. Made of rustproof metal, in three sizes, the anchor has hinged flukes held together by a metal ring. When the latter is lifted, the flukes drop into the spread position, and are locked.

Self-Loading Truck Handles Beer Kegs

BEER KEGS are loaded and unloaded automatically by a novel delivery truck just introduced. Controlled by a lever at the back, a moving floor carries full kegs to the rear of the truck where they roll out three at a time into a convenient trough which can be lowered to ground level. Empty kegs placed in the trough are picked up by a carrier unit, raised on a crane to the top of the truck body, and deposited at the forward end, as illustrated. Power to operate the mechanisms is supplied through special gearing by the truck's motor.



How full kegs are unloaded and empties are taken aboard by the automatic beer truck

War

NEW TINY WEAPONS FOR LAND, SEA, AND SKY MAY REVOLUTIONIZE BATTLE TACTICS



In naval battles of the future, great warships may be destroyed by flying torpedoes, powered by built-in motors and guided straight at their targets by radio control. These could also be used on land

PROFITING by the lessons of recent foreign wars, in which gigantic tanks, huge bombing planes, and other ponderous fighting machines failed to outmode standard battle tactics (P.S.M., Jan. '38, p. 25), American inventors are turning toward smaller, more accurately controlled war weapons to bolster our military and naval strength. To supplement the operations of infantry, a speedy land fighting unit has been developed in the form of a mobile, armored machine-gun nest, running on a chain-driven endless tread, manned by one gunner and one pilot, and mounting a machine gun that is removable for stationary use on the ground. Also for Army use is a lightweight flying tank, designed to speed across enemy lines at 200 miles an hour, drop to the ground, shed its detachable wings, and advance as a land unit mounting one machine gun in front and another in a central telescoping turret. The effec-

tiveness of aerial bombardment, it is expected, will be increased by a radio-controlled flying torpedo now being given flight tests. This unit, powered by a built-in motor and pusher-type propeller, is guided straight for its target by radio control from an accompanying plane or from a ground station. Similar to this is a winged bomb that could be launched from the undercarriage of a multimotored plane and

striking power to the individual fighter.

Many military experts, after studying the performance of mammoth machines in the "test-tube" wars of Ethiopia, China, and Spain, believe that these Goliaths of battle may meet their match in the mechanical Davids now being perfected by the inventors.

MACHINE GUN ON STANDARD MOUNT CAN BE REMOVED AND SET UP IF TANK IS DAMAGED

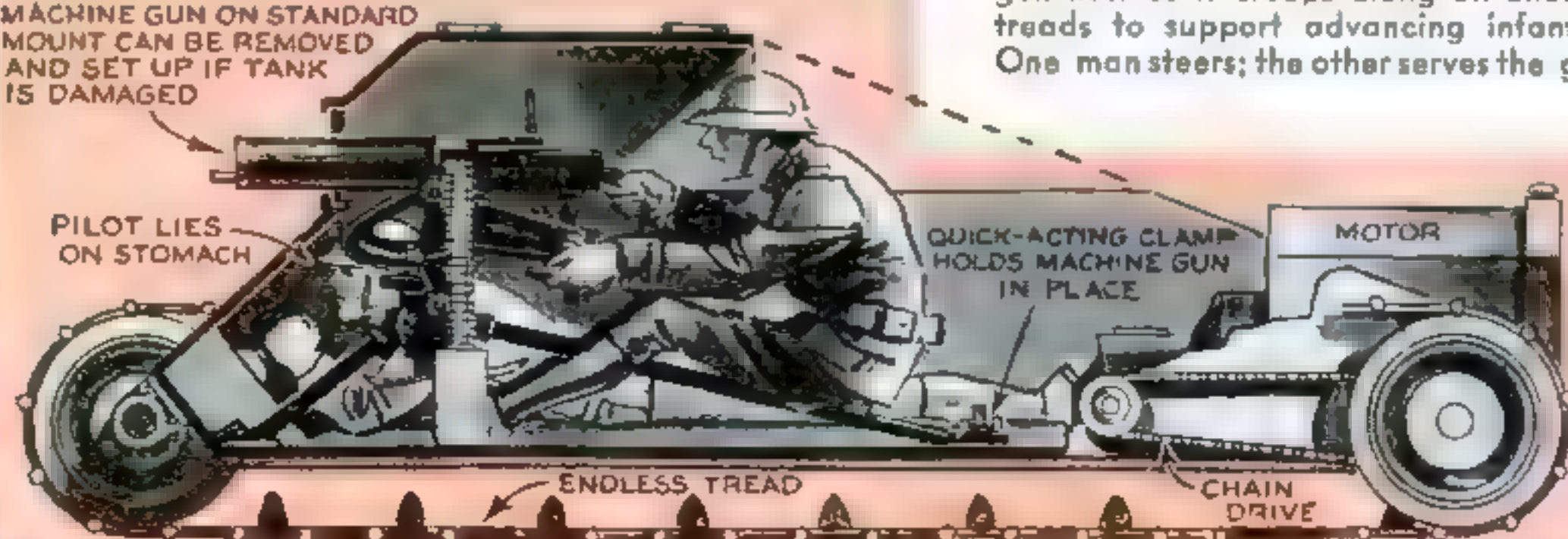
PILOT LIES ON STOMACH

QUICK-ACTING CLAMP HOLDS MACHINE GUN IN PLACE

MOTOR

ENDLESS TREAD

CHAIN DRIVE



Two soldiers man this mobile machine-gun nest as it creeps along on endless treads to support advancing infantry. One man steers; the other serves the gun

Machines Go Midget

Winged tanks, landing behind enemy lines, would shed their wings and advance on wheels. Each mounts two machine guns, one in the telescoping turret



Steered like gliders, winged bombs are aimed directly at their objective by lone pilots who then bail out with their parachutes

A one-man submarine, armed with a single torpedo, is designed to be carried on a battleship. Lowered into the water, it could maneuver close to a hostile vessel and discharge its deadly missile, making sure of an effective hit in a vital spot

Illustrations by
B. G. SEIELSTAD

POPULAR SCIENCE

Question Bee

Here is a set of interesting questions and, as you'll probably agree, some remarkable answers, inserted to give you as little help as possible. As you'll soon discover, only one of the let-

tered answers fits the numbered question with which it is grouped. Make a list of the answers you think are right. Then turn to page 102 and follow directions for figuring out your score



1 What turns a nut when you apply a monkey wrench to it is (a) centrifugal force (b) friction (c) torque (d) osmotic pressure (e) screw propulsion (f) gravitation.

2 Vitreous humor is the name given to (a) a biting form of sarcasm (b) a transparent jellylike substance filling the inner part of the eyeball (c) moisture that condenses on window panes and other cold glass surfaces.

3 A Bendix drive is used to (a) run a dentist's drill (b) turn an astronomical telescope to compensate for the apparent motion of the stars (c) connect a self-starter to an automobile engine.

4 The water obtained by melting a pound of ice weighs (a) more than a pound (b) less than a pound (c) just one pound.

5 A solenoid is (a) a magnetic coil of wire (b) an animal like a lobster or crab (c) a seven-sided prism (d) a minor planet.

6 The principle of the conservation of energy can be summed up as follows: (a) Natural resources like coal and petroleum should not be wasted (b) Energy can neither be created nor destroyed (c) You should perform all physical tasks in the easiest possible way in order to conserve your energy.

7 Brass is (a) a chemical element (b) an alloy (c) a carbohydrate (d) a plastic (e) a pure metal.

8 Printed messages may be transmitted over wires by (a) stereotype (b) prototype (c) daguerreotype (d) teletype (e) logotype.

9 "Mercator's projection" is the term applied to (a) the long snouts of animals like anteaters (b) a method of drawing maps of the world (c) an optical phenomenon employed in throwing television images on a screen (d) a supporting member of a cantilever bridge (e) the extended part of a business graph used for predicting conditions beyond the point representing the present.

10 As any chemist knows, an acid like sulphuric acid can be neutralized with an alkali like (a) alcohol (b) table salt (c) tallow (d) lye.

11 The narrow path in which we see the planets travel across the sky is known as the (a) ecliptic (b) apogee (c) line of least resistance (d) spiral of Archimedes.

12 Low gear speeds on a car are used for starting and in hill climbing to (a) save gasoline (b) keep the motor from overheating (c) avoid exceeding the capacity of the power plant to deliver the required horsepower.

13 Gregor Johann Mendel, famous Austrian scientist of the nineteenth century, is noted for his studies of (a) hydraulics (b) magnetism (c) heredity (d) X rays (e) communicable diseases (f) optics.

14 The tiny animal that builds coral reefs is called a (a) diatom (b) polyp (c) basilisk (d) platypus (e) tesseract.

15 The disease of goiter, characterized by an enlargement of the thyroid gland in the neck, has been traced to a lack in the diet of (a) calcium (b) iodine (c) vitamin D (d) car-bolic acid.

16 Hack saws are useful for cutting (a) wooden boards (b) pieces of metal (c) panes of glass (d) thin slices of biological specimens for examination under a microscope.

17 The black stuff in lead pencils is (a) lead (b) hydrocarbon (c) graphite (d) a product manufactured from the inky fluid of the squid.

18 To look at protozoa, you would need a (a) polariscope (b) microscope (c) stereoscope (d) fluoroscope (e) spinthariscopes.

19 Copper is used for electric wires because it is one of the best (a) insulators (b) conductors (c) dielectrics (d) shock absorbers.

20 This country has a virtual monopoly of the world's supply of (a) rubber (b) tin (c) radium (d) helium.

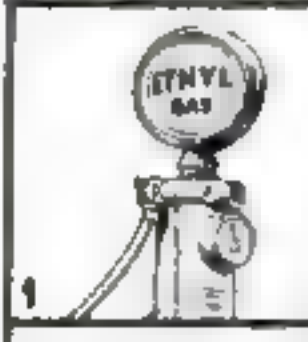

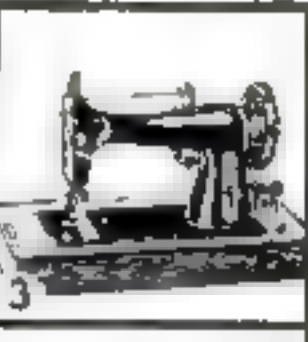


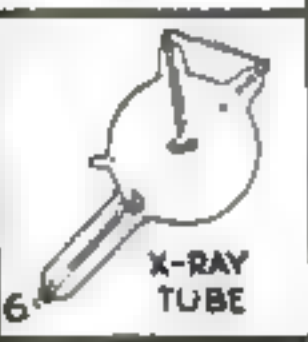



21 Asbestos is (a) an animal product (b) a vegetable product (c) a mineral.

22 Bunsen burners are used to (a) heat houses (b) incinerate rubbish (c) generate steam in marine boilers (d) provide heat for experiments in chemical and physical laboratories.

23 A pencil placed in a glass of water looks bent because of (a) reflection (b) refraction (c) hydration (d) condensation (e) tergiversation.

24 A kind of microscopic organism found in pond water, notable for its peculiar whirling motion, is known as a (a) spinning jenny (b) Rotarian (c) rotifer (d) whirling dervish.

25 Sugar is obtained not only from sugar cane but also from other important sources, including (a) radishes (b) beets (c) spinach (d) broccoli (e) asparagus.

 1	 2	 3
 4	 5	 6
 7	 8	 9

From this jumbled list, select the name of the inventor who pioneered in the development of each of the inventions suggested above. Answers on page 102

Watt	Howe	De Forest
Sholes	Kettering	Stephenson
Röntgen	Berliner	Leeuwenhoek

Un-Natural History

By
GUS MAGER



IT HAS BEEN GENERALLY BELIEVED THAT TOBACCO WAS UNKNOWN OUTSIDE OF AMERICA BEFORE IT WAS INTRODUCED INTO ENGLAND BY SIR WALTER RALEIGH AND OTHERS IN THE SIXTEENTH CENTURY.

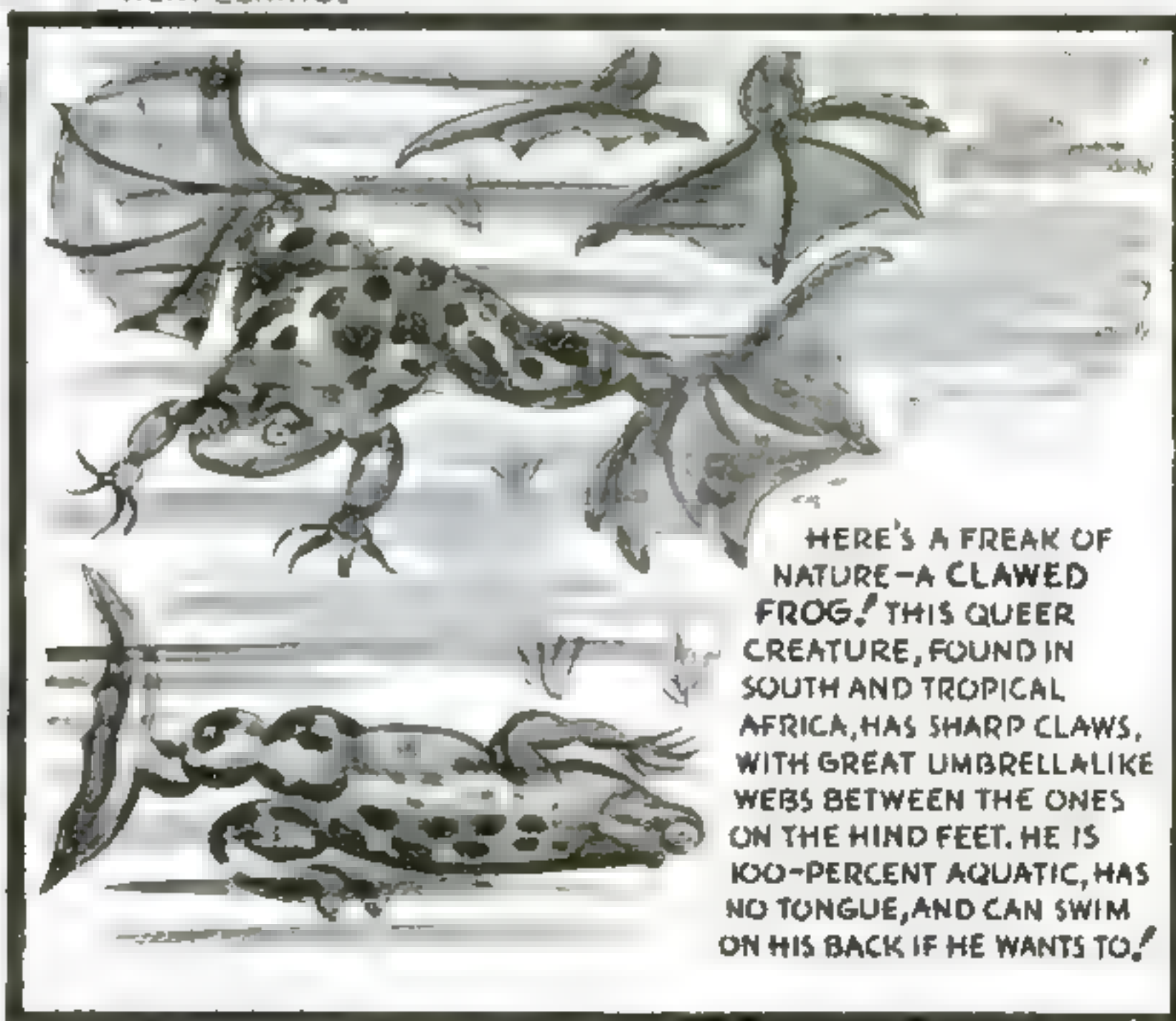
HOWEVER, IT IS NOW CLAIMED THAT THE SOOTHING WEED WAS KNOWN AND WIDELY USED IN NEW GUINEA, MALAY ARCHIPELAGO, AT A MUCH EARLIER DATE.



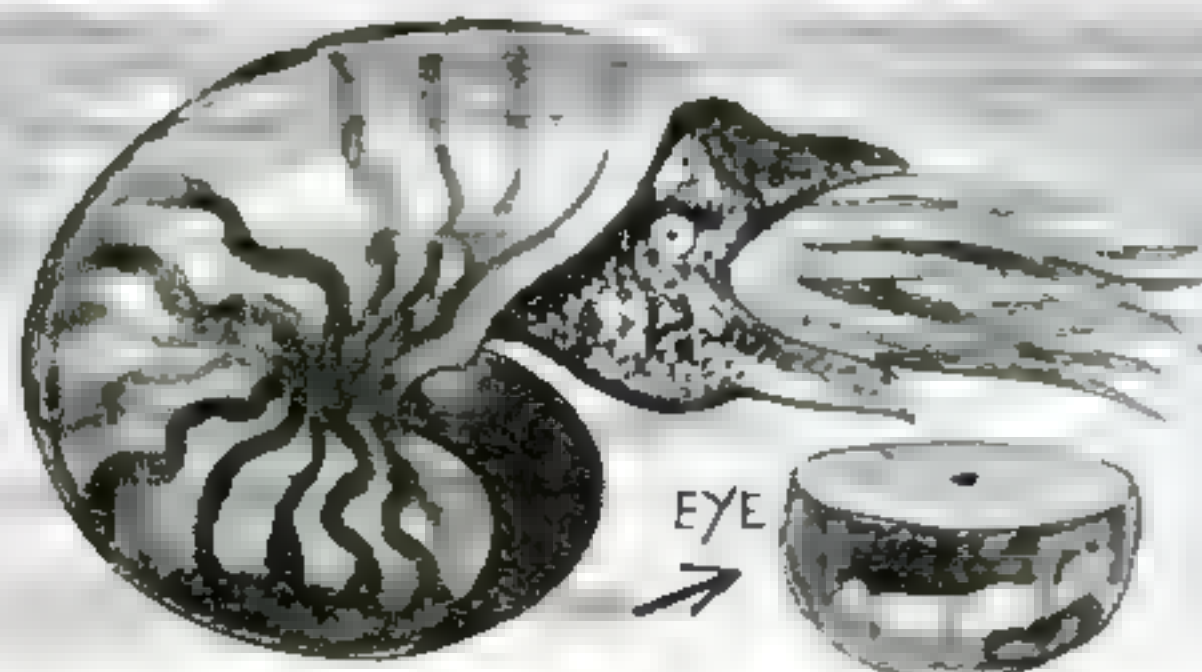
FATHER LOVE IS THE RULE IN THE FAMILY LIFE OF THE EMU OF AUSTRALIA. ALL MRS EMU DOES IS LAY THE EGGS HER SPOUSE SITS FAITHFULLY AND BROODS THEM FOR SIXTY DAYS, THEN REARS THE YOUNG ALL BY HIMSELF — EVEN CHASING THE FEMALE AWAY IF SHE TRIES TO INTERFERE. TALK ABOUT HENPECKING!



SEA LIONS ARE VERY SENSITIVE TO VIBRATIONS IN WATER. IT IS SAID THAT EARLY IN THE WORLD WAR, BEFORE UNDERWATER LISTENING DEVICES HAD BEEN PERFECTED, ALL THE PERFORMING SEA LIONS IN ENGLAND WERE CONSCRIPTED TO STAND GUARD AGAINST SUBMARINES. MOORED AT INTERVALS AROUND THE COAST, THEY WERE TAUGHT TO BARK VIGOROUSLY WHEN THEY SENSED THE APPROACH OF U-BOATS.



HERE'S A FREAK OF NATURE — A CLAWED FROG! THIS QUEER CREATURE, FOUND IN SOUTH AND TROPICAL AFRICA, HAS SHARP CLAWS, WITH GREAT UMBRELLALIKE WEBS BETWEEN THE ONES ON THE HIND FEET. HE IS 100-PERCENT AQUATIC, HAS NO TONGUE, AND CAN SWIM ON HIS BACK IF HE WANTS TO!



THE EYE OF THE PEARLY NAUTILUS IS DIFFERENT FROM THAT OF ANY OTHER CREATURE. IT HAS NEITHER PUPIL NOR LENS, YET THE MOLLUSK HAS PERFECT VISION. THE EYE RESEMBLES A KETTLEDRUM, WITH A THIN MEMBRANE STRETCHED ACROSS IT. IN THE CENTER IS A TINY HOLE THAT ADMITS SEA WATER TO THE CAVITY TO TAKE THE PLACE OF A LENS.

OUR COMMON NEWT (*DIEMYCTILUS VIRENS*) LEADS A DOUBLE LIFE. SOON AFTER REACHING MATURITY IT QUITS THE WATER, DONS A VERMILION DRESS, AND LIVES THE LIFE OF A LAND CREATURE. AFTER TWO OR MORE YEARS IT RETURNS TO THE WATER, RESUMES ITS GREENISH-BROWN COLOR, AND SETTLES DOWN WITH A MATE.



New Inventions



MUSICAL CAKE BOARD. A birthday cake set on the round wooden top of this cake board revolves slowly while the familiar tune, "Happy Birthday to You" tinkles from a music box inside. The device is wound as seen at the right



COLLAPSIBLE CLOSET. An extra closet for guests is provided by the fixture at the right. When not in use, it can be folded into a compact bundle for convenient storage



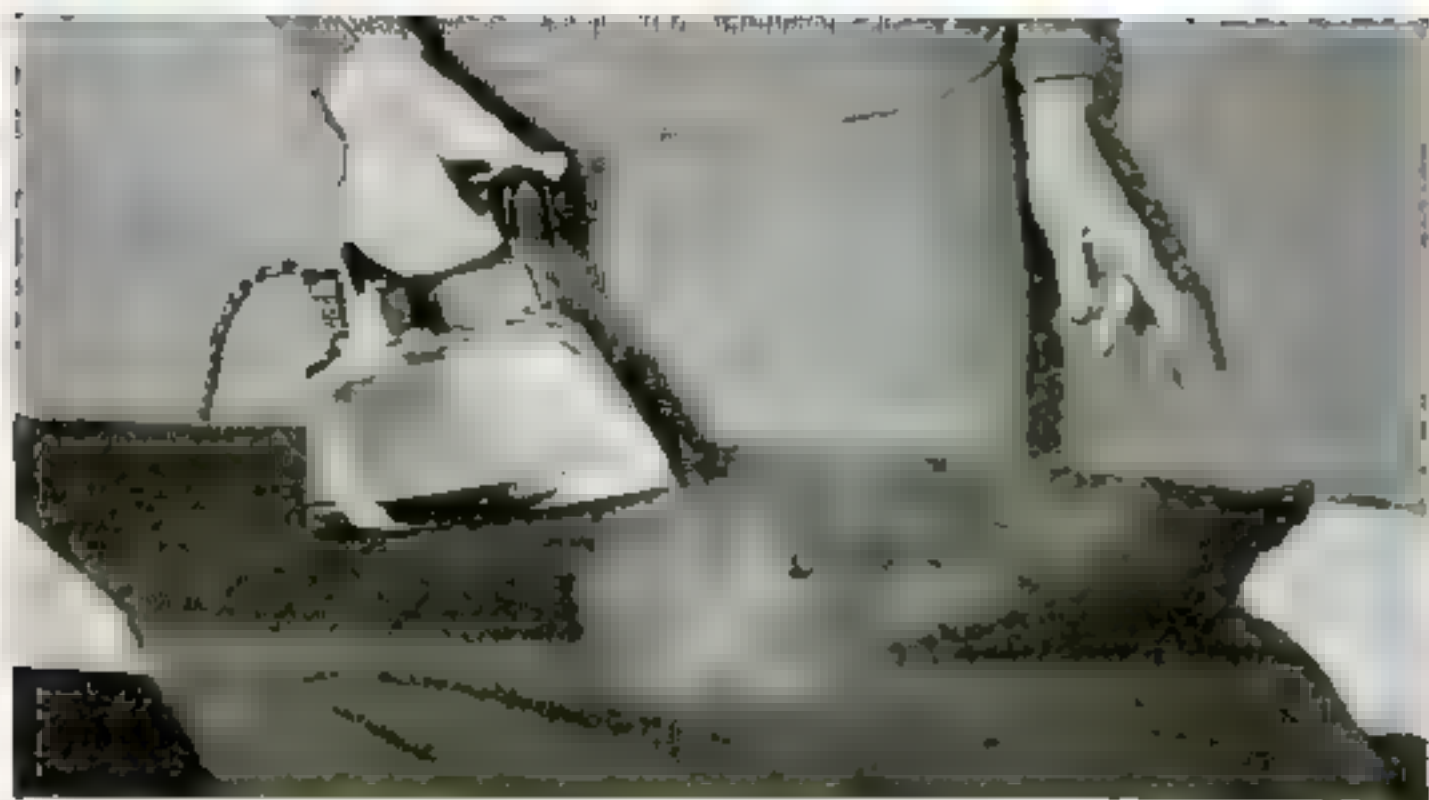
BOOKCASE HUMIDIFIER. Designed as an end table with two shelves for books and magazines, the piece of furniture shown above houses an air-conditioning unit that sucks in air, washes and humidifies it, and returns it to the room fresh and pure



STOVE-TOP ITEMS. The flat bottom of this new aluminum griddle for electric stoves gives direct contact with the heating element. Two perforated metal plates form the efficient, easily cleaned surface oven for gas ranges illustrated below

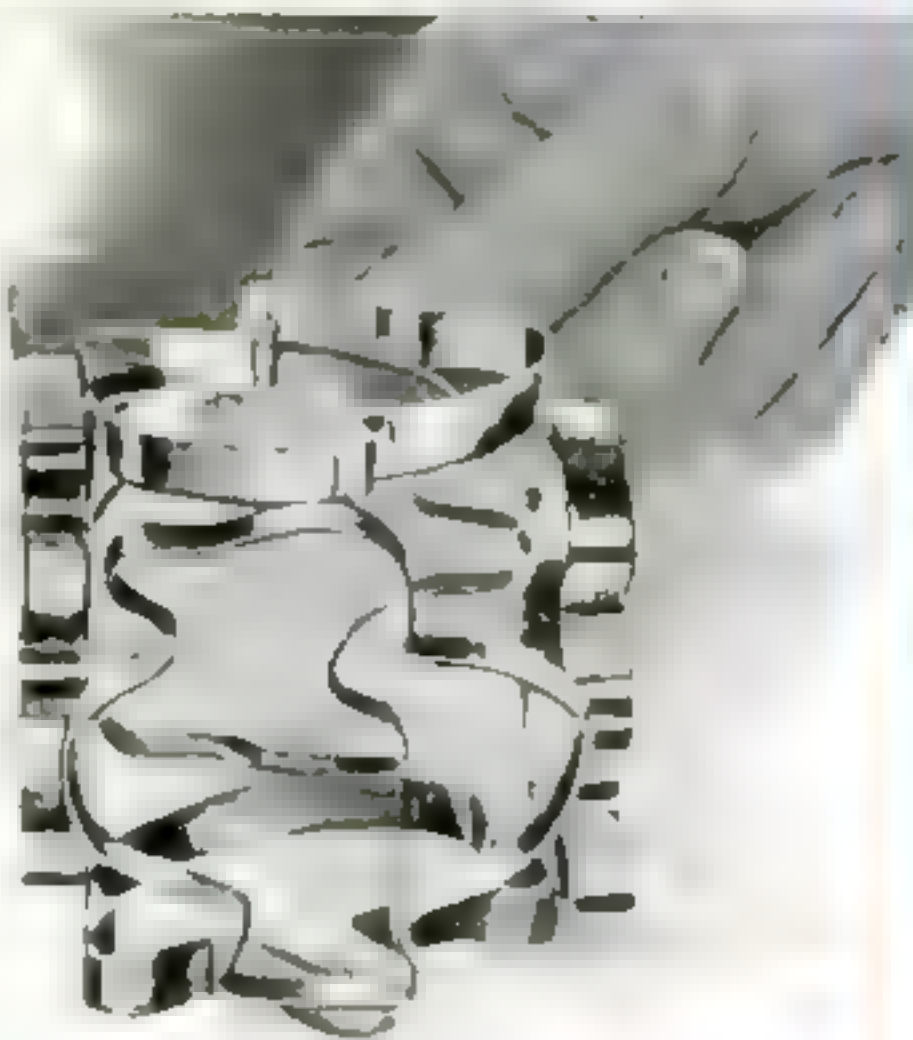


Meet Household Needs



STEAM-ELECTRIC IRON. Clothes are dampened and pressed at the same time by a new electric iron. A reservoir holds water which turns into steam that issues from holes under the pointed end

SANDWICH CUTTER
Seven sandwich cutters are combined in one, in the utensil shown at the right. Each side is an individual pattern



WASHER AND IRONER
This space-saving unit has an electric ironer mounted above the washer tub. When not in use, ironer swings aside



ONE-EGG POACHER
A single egg can be poached conveniently in the utensil pictured at the right, consisting of a pan, lid, and inset for the egg



LAUNDRY MARKER
Initials are stamped indelibly on linen and white goods by the electric device below. Any combination of letters can be used

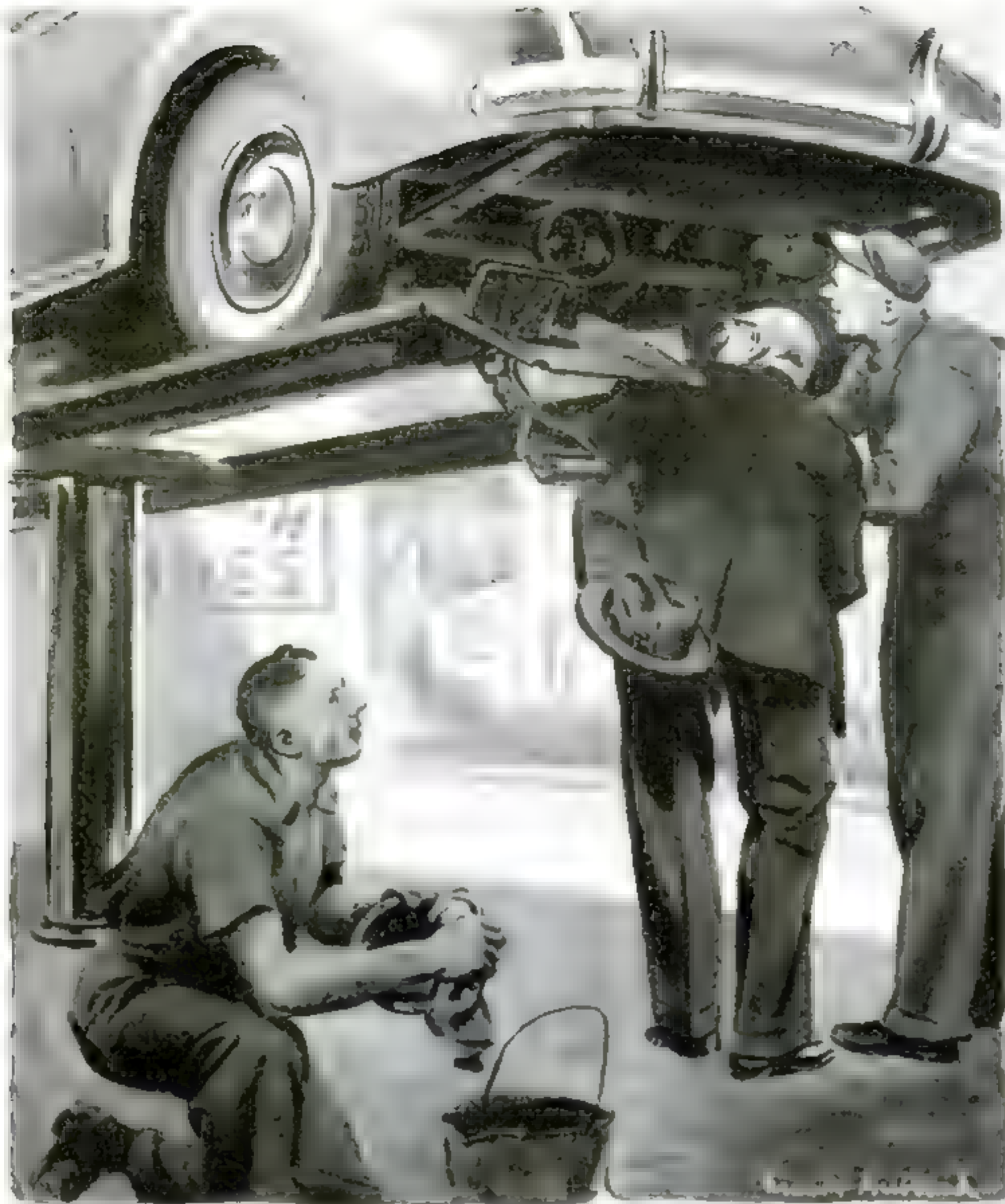


DOOR PULLS. Strips of colored material inserted in new metal door pulls match any decorations

MOTH SPRAYER. Hooked up to a vacuum cleaner, the spraying device at the left shoots mothproofing solutions into clothing and furniture upholstery fabrics



By
MARTIN BUNN



"That's a new one on me," Brown admitted. "What the devil ARE galled gears?"
"Look for yourself," Gus invited, and the car owner peered intently into the gear case

REAR ENDS Aren't Foolproof

IT WAS a summer Wednesday afternoon. All the regular customers of the Model Garage who had met with motoring misfortunes on their week-end jaunts had already been in to tell Gus Wilson their tales of woe and to have their troubles taken care of, and those who were planning to start on trips Saturday noon hadn't yet got around to driving their cars in for check-ups and lubrication. There really wasn't anything much to do, and Gus—who always has purposeful energy to spare when there is need of it—was leaning against the wall outside the office and enjoying a whole-souled loaf as he waited for some one to drive up to the pump and ask for five gallons of gas. From inside the office came an un-

even *click—click—click—click* as his partner, Joe Clark, picked out an accessories order on his ancient typewriter. Through the wide-open doors of the shop floated intermittently the pleasant ringing of a machinist's hammer on steel, and the considerably less musical sound of Harry singing the latest popular song.

The honk of a horn made Gus look up. A car was turning into the driveway. And it was Mrs. Miller's car. Gus ducked hastily into the office. "Hey, Harry!" he called to the mechanic. "Take care of this customer, will you? I'm busy!"

Joe Clark looked up. "What's the matter?" he demanded.

"Quiet!" Gus cautioned him. "It's Mrs. Miller, and it's a lot too hot to

listen to her talk for an hour or two!"

"Not for me," said Joe. "I wish we had a few more like her on the books. Say, that woman can do more things to a car in driving down to the chain store than most people can in driving from here to Canada and back!"

Joe went out front. For a moment Gus heard his voice and Harry's; then Mrs. Miller's going on and on in a shrill and exclamatory monologue. After a few minutes, Harry put his grinning face in at the door. "Say, Gus, here's a funny one," he said. "You better have a look at it."

"Funny ones" are Gus Wilson's long suit. He went out with Harry without an objection.

Mrs. Miller was telling her troubles to Joe Clark for the third time. Mrs. Miller's idea of describing automobiling grief is to work in all the technical terms that she is able to remember out of the many repair-shop conversations that have been occasioned by her numerous harrowing experiences—although she hasn't the haziest idea of what most of them mean. "It was terrible," she was saying. "In all my life I've never heard such an awful grinding noise in a car. I don't know what Mr. Miller will say, I'm sure. Every time I got up to thirty-five, I thought that the motor was coming apart—*absolutely coming apart!* Maybe it's the transmission—or the distributor. Yes, I'm sure it must be the distributor. Harry, please look at the distributor. Now where has that Harry gone to?"

"I'm right here, ma'am," said Harry. "And here's the boss. He'll soon fix you up."

Mrs. Miller turned her stream of conversation on Gus, and drenched him with it. She had driven to a near-by town to call on a friend. On the way, she had remembered that her husband had cautioned her not to forget to stop at the Model Garage and have the oil changed. To save time, she had had the change made at a service station while she visited with her friend. The car had run all right when she had started for home. But as soon as she had got out of traffic and speeded up, the grinding noise had started. And the faster she went, the worse it had become. When she had slowed down to below twenty miles it had stopped. "It must be the distributor," she concluded. "Don't you think it is the distributor, Mr. Wilson?"

Wooden-faced except for a furtive wink at Joe Clark, Gus admitted that it might be the distributor—or even the differential. "It isn't anything that can't be fixed," he reassured her hastily. "Hop in, Harry, and turn her over."

Harry hopped in and turned the motor over. The engine ran quietly. Then Harry pressed his foot down on the accelerator—and at once a high-pitched grinding sound filled the shop.

Gus motioned to Harry to stop the engine. *(Continued on page 97)*

THE HOME WORKSHOP

Primarily designed for fishing, this new boat has plenty of stability and buoyancy for use on open waters. It is 11 ft. 6 in. long, 4 ft. in beam, and 15½ in. deep



LOW-COST Outboard Boat

By
WILLARD
CRANDALL
from a design by
BRUCE N.
CRANDALL

FOR FISHING AND FAMILY USE



A batten is clamped in position to serve as a guide for obtaining a true curve and the proper bevels for the chine line. The hull is built upside down on a well-braced form

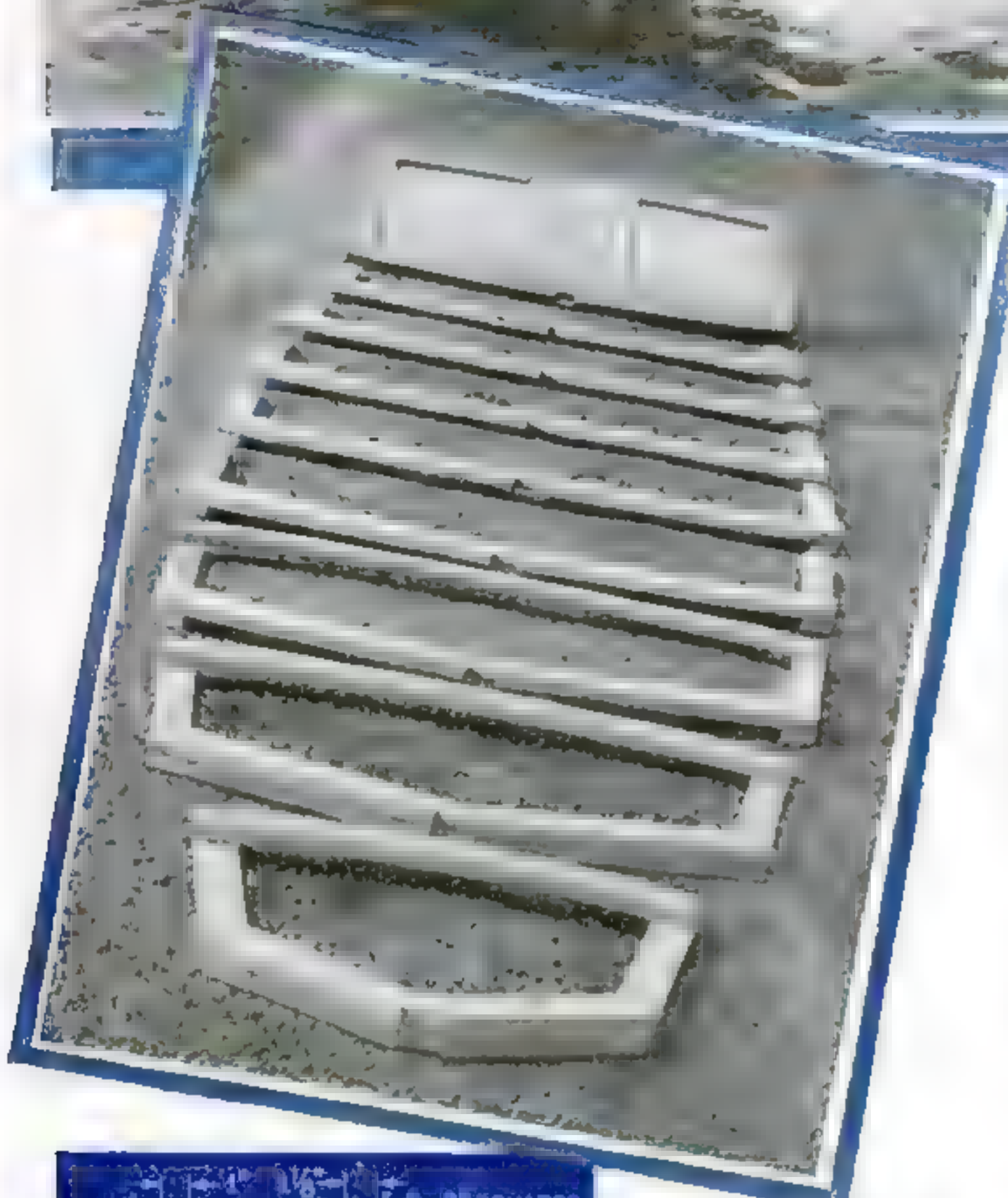
Light, buoyant, and seaworthy, the craft is designed especially for small motors or oars, but it will plane like a speedy runabout if more heavily powered

HERE is a new fisherman's outboard boat that has an exceptionally wide range of usefulness. It is light, perfectly adapted for small motors, and handles well with oars—three qualities desired by all fishermen.

With a larger motor, it becomes a fast runabout and planes nicely. Practically no speed is sacrificed in obtaining its excellent riding quality, and the chop of the waves is cut through with remarkably little bounce. Any motor from 3 to 16 h.p. may be used. With a 9-h.p. motor speeds up to 25 m.p.h. are easily possible, and 35 m.p.h. with one of 16 h.p.

Designed for fishing and all-around use as a family boat at a summer cottage, the hull is seaworthy enough for open bodies of water and has plenty of buoyancy for three or four adults. Two men can lift it without difficulty onto a light trailer. Batten-seam construction prevents leaking no matter how often the boat is dried out. The cost of building the boat in most cases will be less than \$25, including hardware and fittings.

The principal measurements are: length, 11 ft. 6 in. over all; beam, 4 ft., and depth amidships, 15½ in. Built with



MATERIALS FOR THE FISHERMAN'S BOAT

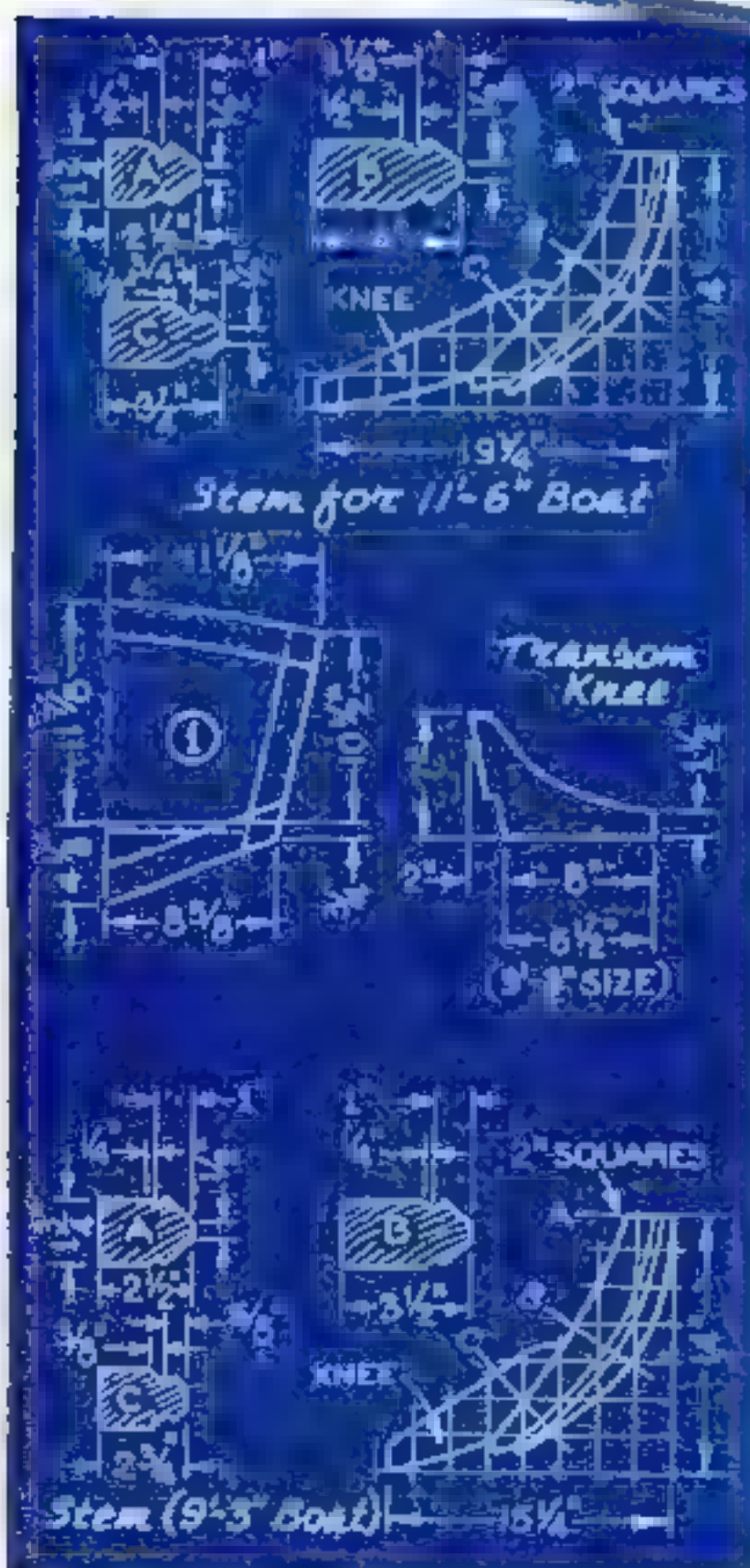
White cedar, red cedar, mahogany, cypress, redwood, spruce, fir, or white pine (in order of preference)

	For hull 11 ft. 6 in. long	For hull 9 ft. 3 in. long
No. Pc.	No. Pc.	No. Pc.
Size	Size	Size
Plank for decking, transom, and seats	8 3/4" x 6" x 12'	8 5/16" x 6" x 10'
Battens	15 1/2" x 4" x 12'	15 5/16" x 4" x 10'
	12 3/4" x 1 1/4" x 12'	12 3/8" x 1 1/4" x 10'

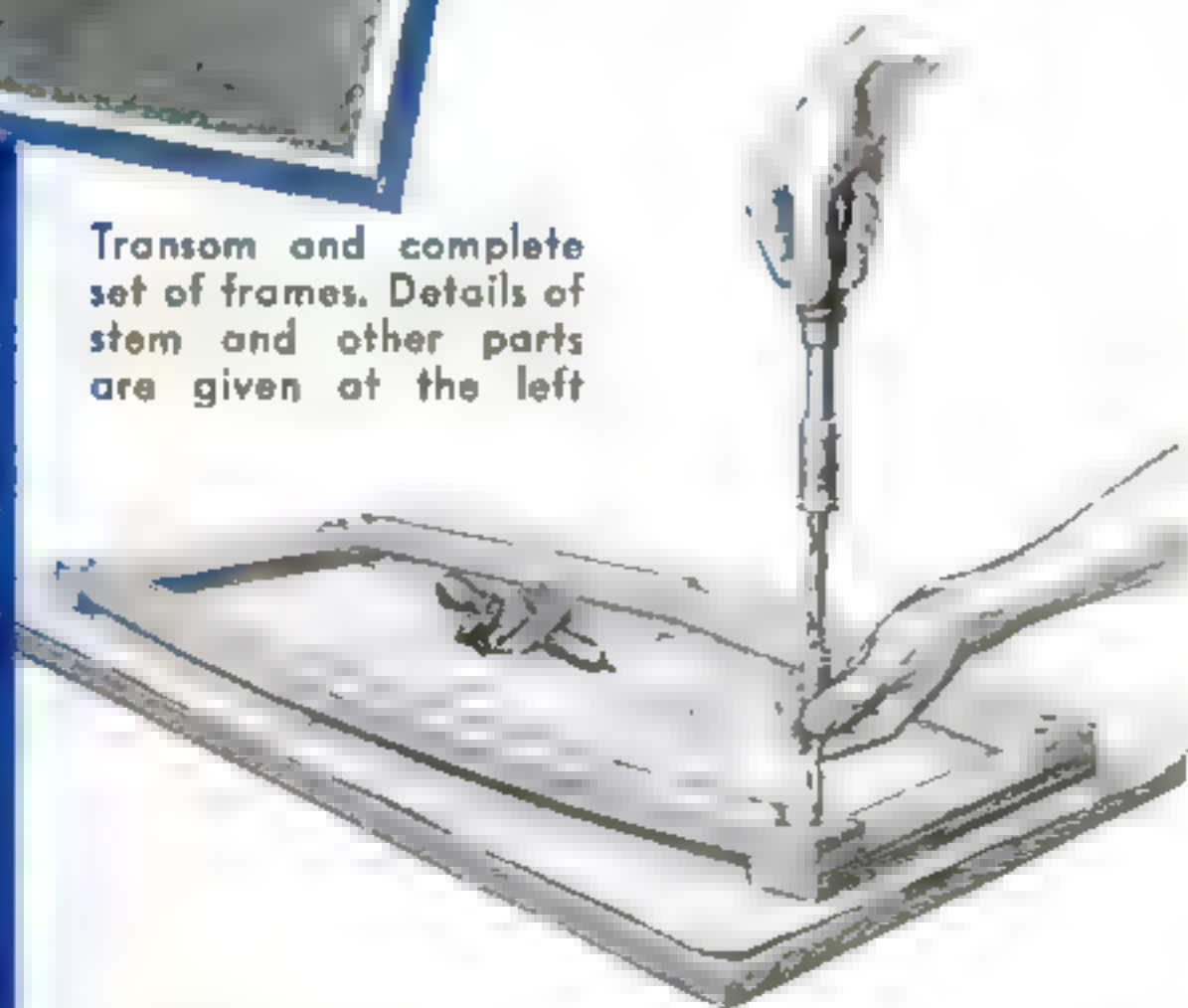
Spruce, mahogany, white oak, fir, cedar, cypress, redwood, or yellow pine

	For hull 11 ft. 6 in. long	For hull 9 ft. 3 in. long
No. Pc.	No. Pc.	No. Pc.
Size	Size	Size
Frames, transom frames, seat frames, motor blocks, deck beams, and keel	60 lin. ft. 3/4" x 1 1/4"	60 lin. ft. 1/2" x 1 1/4"
Floor boards	24 lin. ft. 3/4" x 8"	24 lin. ft. 1/2" x 8"
Chines and inner chines	4 1/2" x 1 1/4" x 12'	4 3/8" x 1" x 10'
Sheer battens and motor	3 1/2" x 1 1/4" x 12'	3 1/8" x 1 1/4" x 10'
Stem, knees, and breasthook	1 1/2" x 6" x 5'	1 1/4" x 6" x 3'
Fender and sheer molding	2 1/2" half-round 18' long	2 1/2" half-round 14' long

Flathead brass, galvanized, or cadmium plated screws as follows: 5 gross 1" No. 7; 2 gross 1 1/4" No. 8; 6 doz. 1 1/4" No. 8; 6 doz. 2" No. 10. Also 4 doz. 1 1/4" No. 10 flathead brass or galvanized machine screws, and 4 doz. No. 10 hexagon nuts; 3 doz. 1 1/4" No. 7 oval-head brass screws; 3 lb. 1" copper or galvanized nails; 1 lb. 1" copper or galvanized nails; 1 qt. marine glue; 4 yd. cotton flannelette; 2 1/2 ft. 1" half oval brass, aluminum, or galvanized iron; 1/2 gal. marine paint and 1 qt. spar varnish; 1 outboard fin 2 1/2" x 6" or larger, cast aluminum; 3 lifting handles, and 1 pair tracks.



Transom and complete set of frames. Details of stem and other parts are given at the left



The frames are placed over the full-size paper patterns while being fastened together at the corners

the center line on these pieces and on all bottom and deck frames. Notches for the keel can now be cut in the exact center of the bottom frames, including the transom frame, but not into the transom planking. The stem, stem knee, and transom knee are next cut out according to the measurements, and the stem and stem knee fastened together with 2-in. No. 10 screws. The exact angles of the stem and rabbet can be determined after the stem is set up in position.

The boat should be built upside down on a framework supported from the floor or from two timbers as shown in the photographs. The essential part of the framework is the keel form on which the keel, stem, stem knee, transom knee and transom, and all the

frames will rest. Cut the keel form from a 1 by 8-in. plank of any cheap lumber according to the measurements given in the drawings. Cut notches where the frames will rest. They should be deep enough so that each keel notch will be flush with the edge

TABLE OF OFFSETS

- TABLE OF OFFSETS -											
DIMENSIONS IN INCHES AND EIGHTHS TO OUTSIDE OF 3/8" PLANKING											
STATION		0	1	2	3	4	5	6	7	8	9
HALF BREADTHS	SHEER		11-4	16-5	20	22	22-7	23	22-4	21-7	21
	WATER LINE					21-3	22-7	23-4	23-5	23-3	23
	CHINE		9	14-7	18-5	21	22-3	22-7	22-7	22-4	22
	INNER CHINE				17-4	17-7	18	18	18	18	18
HEIGHTS FROM BASE	KEEL		2-4	1-4	1-1	1	1	1	1	1	1
	INNER CHINE				3-3	2-1	1-5	1-4	1-4	1-4	1-4
	CHINE	7-4	6	4-6	3-6	3	2-5	2-3	2-2	2-1	2
	SHEER	18	17-4	17-1	16-7	16-5	16-2	15-7	15-5	15-2	15
	DECK	18	18-7	19	19						16

of the keel form. Nail up-
rights to the keel form at
stations 1, 2, 3, 5, and 7; set
the form up at a convenient
height for working, and brace
as shown. The uprights must
be perfectly plumb and at
right angles to the keel form.
The frames should be set in
the notches and temporarily
fastened to the uprights in
such a way that their center
lines are perfectly plumb and
at the center of the keel form.

The keel, stem, stem knee,
transom, and transom knee
may now be set up in place.
Screw the keel to the frames
and transom frame with 1 1/4-
in. No. 8 screws and to the
stem knee and transom knee
with 2-in. No. 10 screws. The
transom is also screwed to the
transom knee with 2-in. No. 10 screws;
but first make sure both are in line.
Fasten the stem and transom in posi-
tion with temporary braces to the floor.

Notches for the chines and inner
chines can now be cut into the frames
and transom frame, but not into the
transom planking. First clamp a bat-
ten in place to make sure of getting a
true curve and the proper bevels. Cut
the chine pieces down to about 3/8 in.
where they are to be notched into the
stem, as deeper notches would weaken
the stem. Now the stem may be dressed
down and the rabbet cut.

Before being fastened, the chines and
front part of keel should be wrapped in
rags and soaked with boiling water.

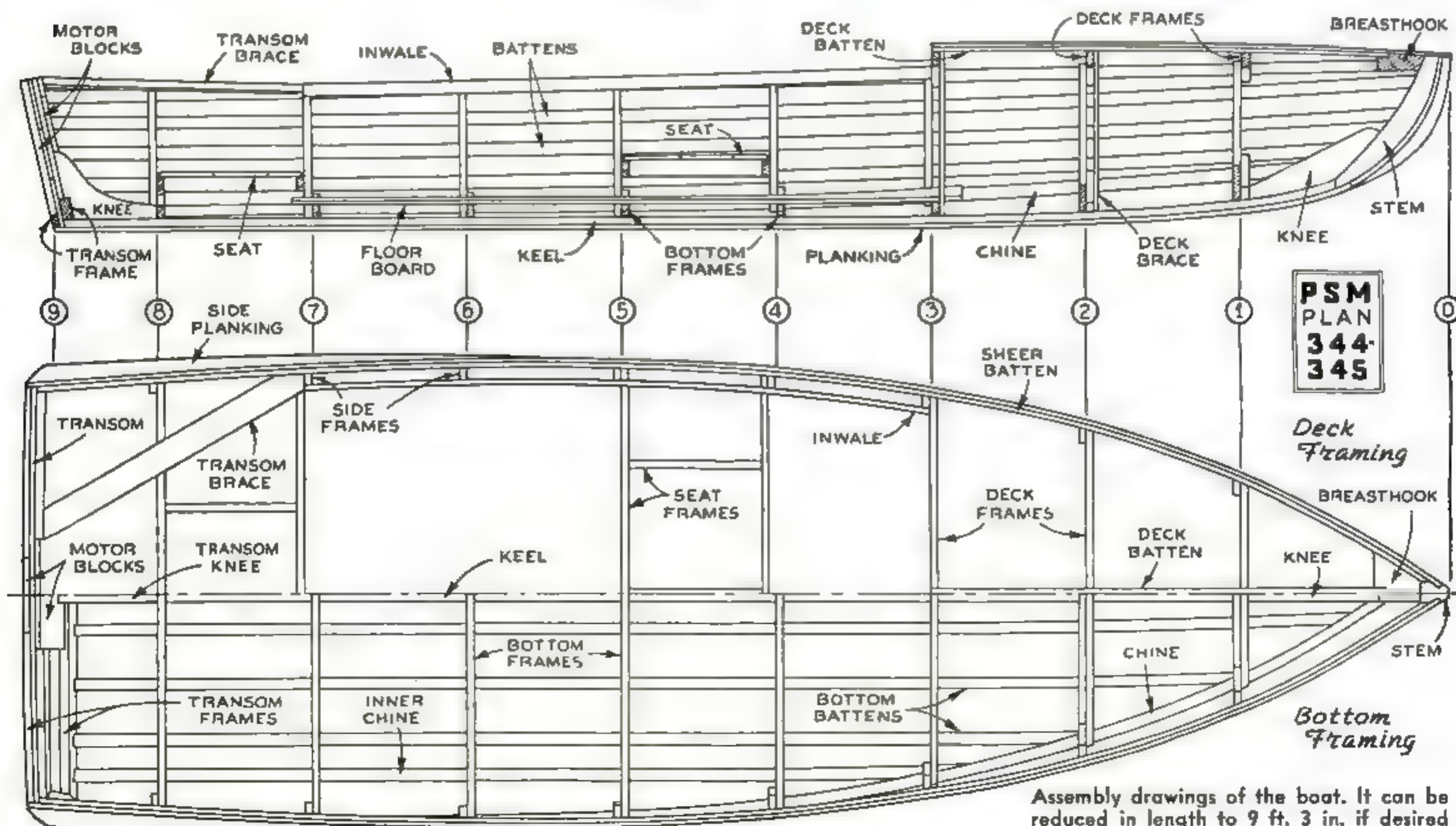
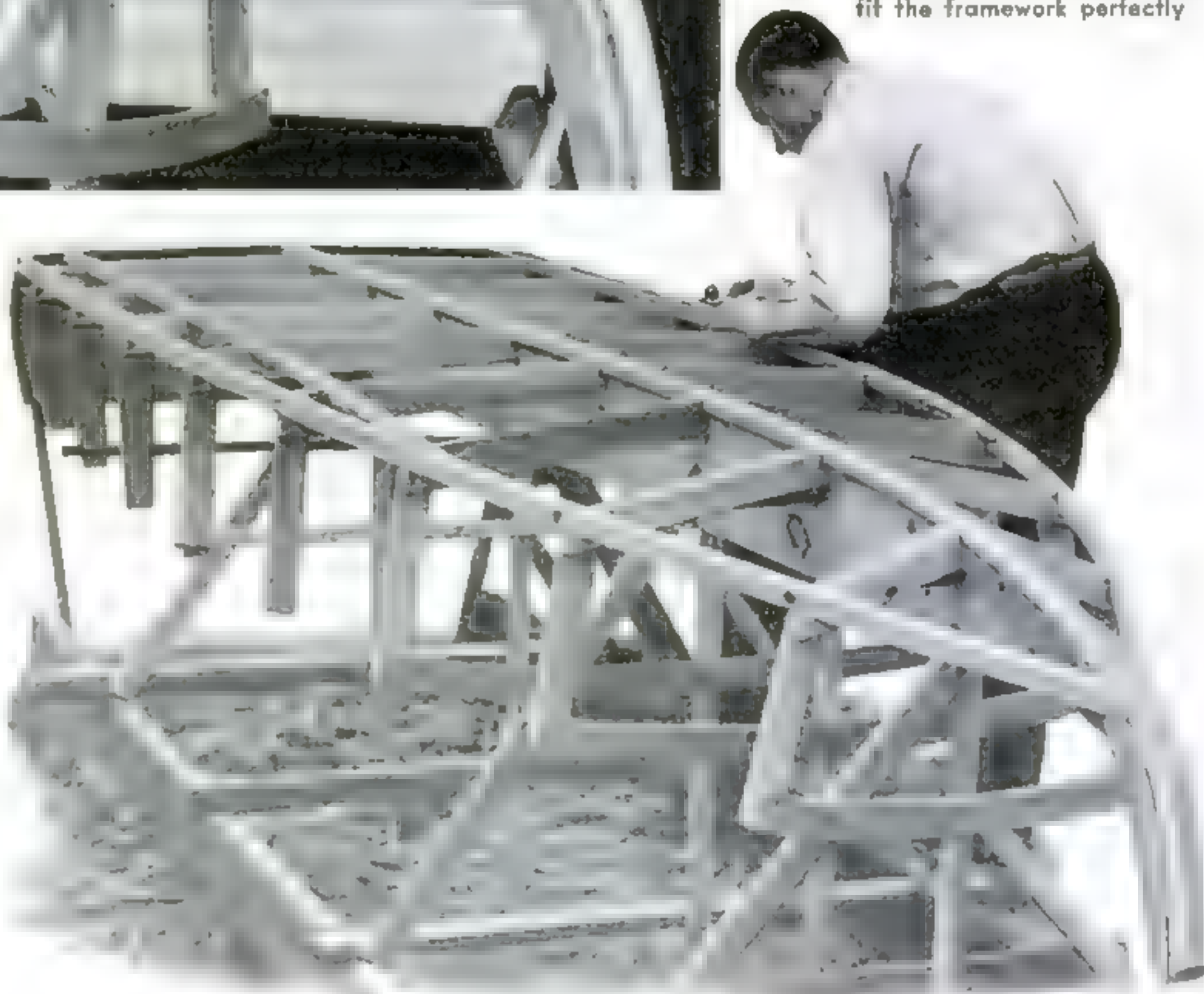
The chines and inner chines should be
fastened to the frames and transom
frame with 1 1/4-in. No. 8 screws. Fasten
the chines at the stem with 1 1/4-in. No.
8 and 2-in. No. 10 screws.

(TO BE CONCLUDED)



A rabbet must be cut into the
stem at the correct angle and
of sufficient depth to receive
the ends of the planking. The
ends of the chines are cut down
to about 3/8 in. where they are
notched into the stem so that it
will not be weakened too much

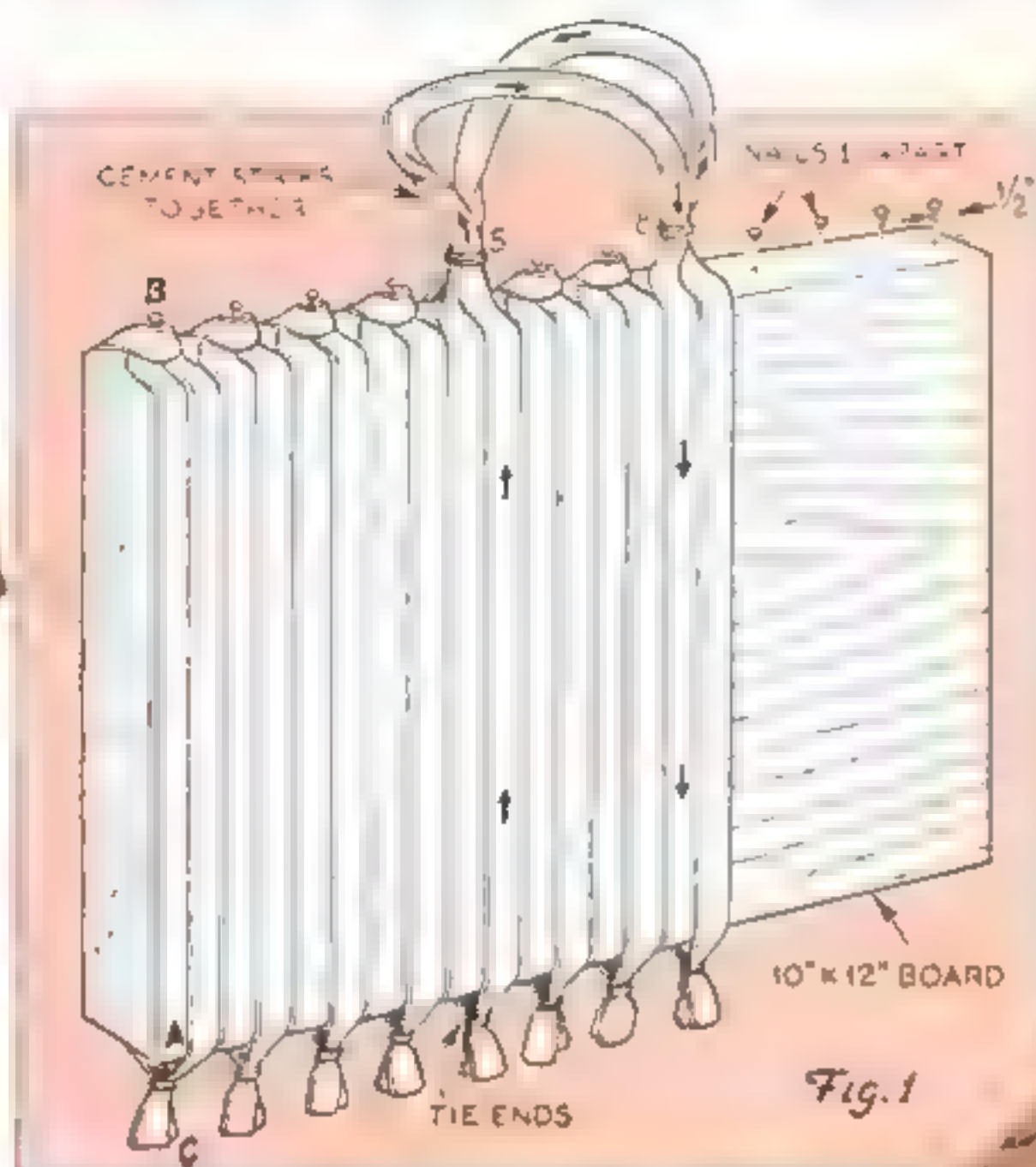
The final step is to true
up the entire frame. Keel,
chines, inner chines, frames,
and transom must be beveled
so that the planking will
fit the framework perfectly



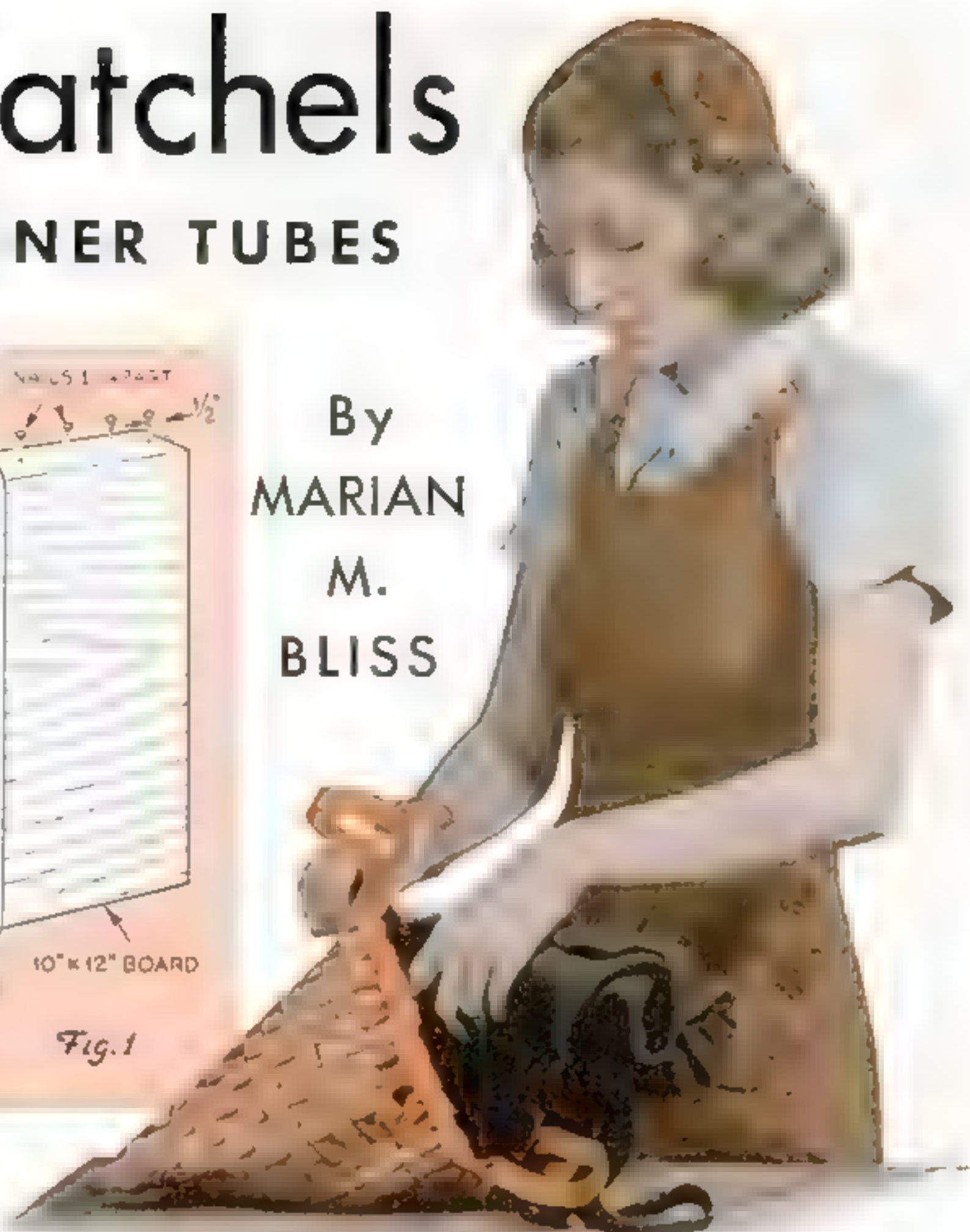
Assembly drawings of the boat. It can be
reduced in length to 9 ft. 3 in. if desired

Swim-Suit Satchels

MADE FROM OLD INNER TUBES



By
MARIAN
M.
BLISS



How the foundation strips of rubber are applied to the wooden form. It should be noted that each handle is made of two pieces, cemented later

DURABLE and attractive bags for carrying swim suits and towels can be made from old automobile inner tubes.

The woven type, shown above, requires a wooden form with nails spaced 1 in. apart along one long edge, starting $\frac{1}{2}$ in. from the end (Fig. 1). Cut $\frac{1}{2}$ -in. wide strips from tubes of two different colors, and do this as near the outer circumference as possible or the strips may be too short.

Take one strip, hold the middle of it against the bottom of the board at A, bring half the strip around the first nail at B, and back to the bottom of the board at C. While holding on to that end, turn the board over and bring the other half of the strip on the other side of the board, around the same nail, and back to the bottom of the board. Tie the two ends tightly together at C, after stretching the strips slightly.

Do the same with the other strips until you come to nail 5. Start a long strip at the bottom, bring it up on the right of nail 5, tie it temporarily to the nail, and carry it high enough to make a handle. Skip two nails, come down to the left of nail 8, and tie temporarily. Bring it down to the bottom, around the other side up to nail 8, and tie. Continue up far enough to form the other handle, and come down to the right of nail 5. Tie it, bring it back to the bottom, and tie to the first end of the same strip.

Start another long strip to the right of nail 8, beginning at the bottom. Bring it up to the nail and tie it to the other handle piece. Carry it up and around to make one handle double thickness. Bring it down to nail 5, and tie it to the other

strip. Then come down around the bottom and up to the nail again. Tie it to the handle on the other side, doubling that handle. Come down at right of nail 8 to the bottom and tie it to the first end of that strip. Fill in the nails between the handle pieces in the usual way, and finish covering the board.

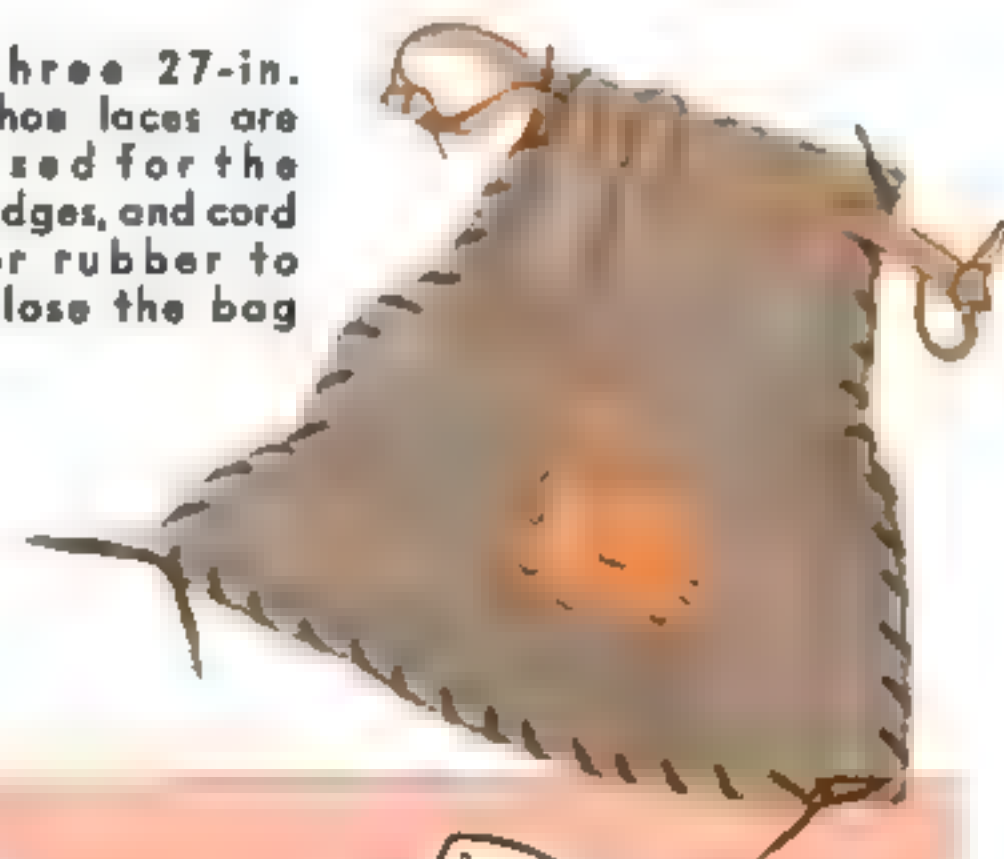
Start weaving with strips of the other color. When you come to the second row, you have to take two of the foundation strips together (just the two on the edge). As soon as you come to the end of a weaving strip, tie a new strip tightly to it with string. Have the joint come under one of the foundation strips. At the very bottom, weave the end in and out under the other strips until it holds. Now pull out the nails, and slip the bag off the board. Weave a strip of the foundation color through at the top to take up

the slack where the nails were fastened.

Cement the ends that have been tied together and where the strips were pieced. Also cement the double thicknesses of the handles. Always roughen the rubber before cementing.

Two simpler bags are shown in Figs. 2 and 3 below.

Three 27-in. shoe laces are used for the edges, and cord or rubber to close the bag



Here the bowed-out part of the tube forms the middle of a sturdy, capacious bag

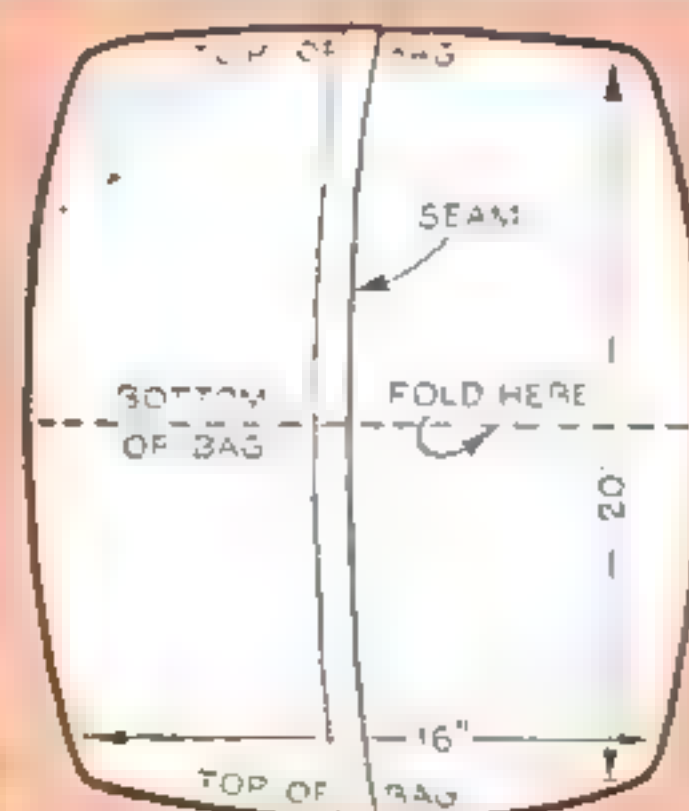


Fig 2

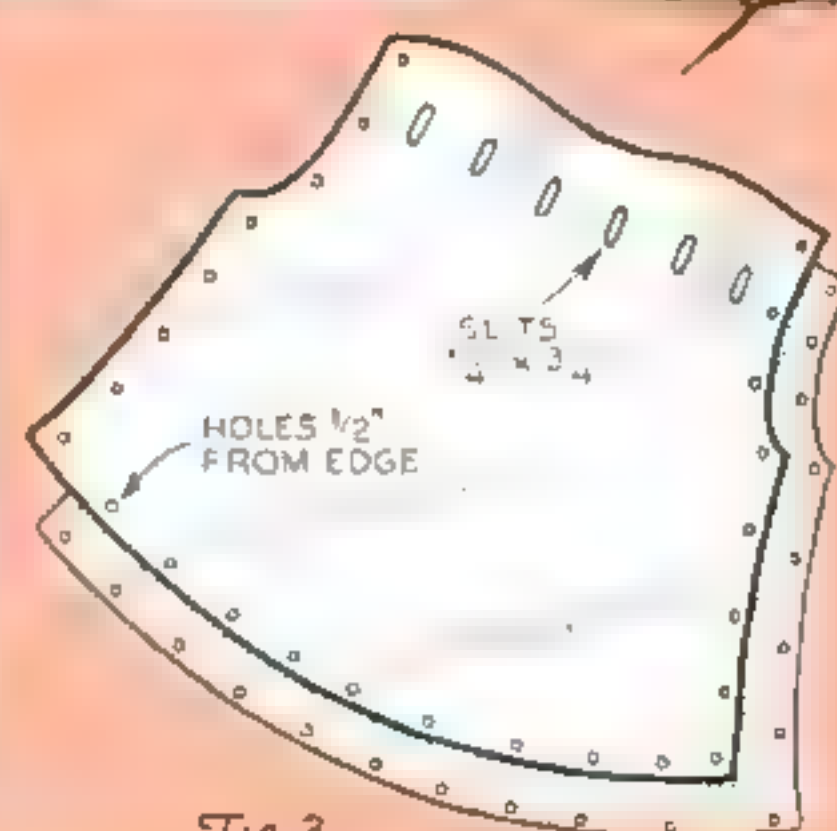


Fig 3

Washing-Machine Hose Held by Suction Cup

Right, remove the hook and use a fire patch as a strap



Firmly held against the side of the washtub, the hose can't thrash about

A HOSE used for filling a washing machine and tubs may be prevented from thrashing around by applying a rubber suction cup an inch or two from the end as shown. If the suction cup is moistened, it will hold the hose securely against the side of the machine or tub. When hot water is used, place the cup above the water level so that it can be removed without burning the hands.

If a drain is available lower than the tubs and machine, they can be emptied by siphoning the water. Fasten the cup so this end of the hose is near the bottom of the tub; then attach the other end to the water supply, fill the hose, disconnect it, make a kink in it if necessary to prevent the water from running out, and place over the drain.—E. E. S.



Compact Cover for Binoculars

MUCH more convenient and durable than the usual case or bag in which inexpensive field glasses are sold is the homemade cover illustrated above. A snug-fitting leather cap is made for each end of the instrument and connected with a piece of leather. The case may be folded with the smaller cap nested inside the larger. Old work shoes provided the leather for the original cover.—JOHN M. AVERY.

Model Yacht Sails of Oiled Silk

MATERIAL similar to that used for women's transparent raincoats and commonly referred to as "oiled silk" is sometimes used for the sails of model racing yachts. Since it is nonporous, the material holds the wind well, and the fact that it is so slippery reduces the so-called "skin friction" of the sails. The model shown below was tried out in the yacht basin at Central Park, New York, with great success.—WALTER GOTTLIEB.



Cut from transparent raincoat material, these sails reduce skin friction and hold the wind



Air Conditioner Constructed from Auto Radiator

A small, continuous stream of water through the radiator is sufficient to reduce room temperature about eight degrees

A GOOD-SIZED room can be cooled almost instantly by the homemade air-conditioning unit illustrated. A stream of water about $\frac{1}{4}$ in. in diameter flowing through the radiator is usually sufficient to keep the temperature from 7 to 8 deg. below that elsewhere in the house, and the cost of operation, according to close figuring, is about eleven cents a day.

Besides the electric fan, which should be of fairly large size (not smaller than 11 in. in diameter), the principal parts are an old automobile radiator, which cost \$3.50, and a discarded, old-style radio cabinet, bought for fifty cents. The shutters, which enable the breeze to be directed as desired, came with the radiator. Any available type may be used.

The method of assembly is made clear in the drawings. The water can be piped to the inlet in any convenient way. The outlet, if carried to a drain, should not, of course, be connected below the trap, for sanitary reasons.



One effect of the air conditioner, which also adds greatly to comfort on humid days, is to condense considerable moisture out of the air as it passes through the radiator. The water is collected in a small pan and drained once a day.—CASE VIS.

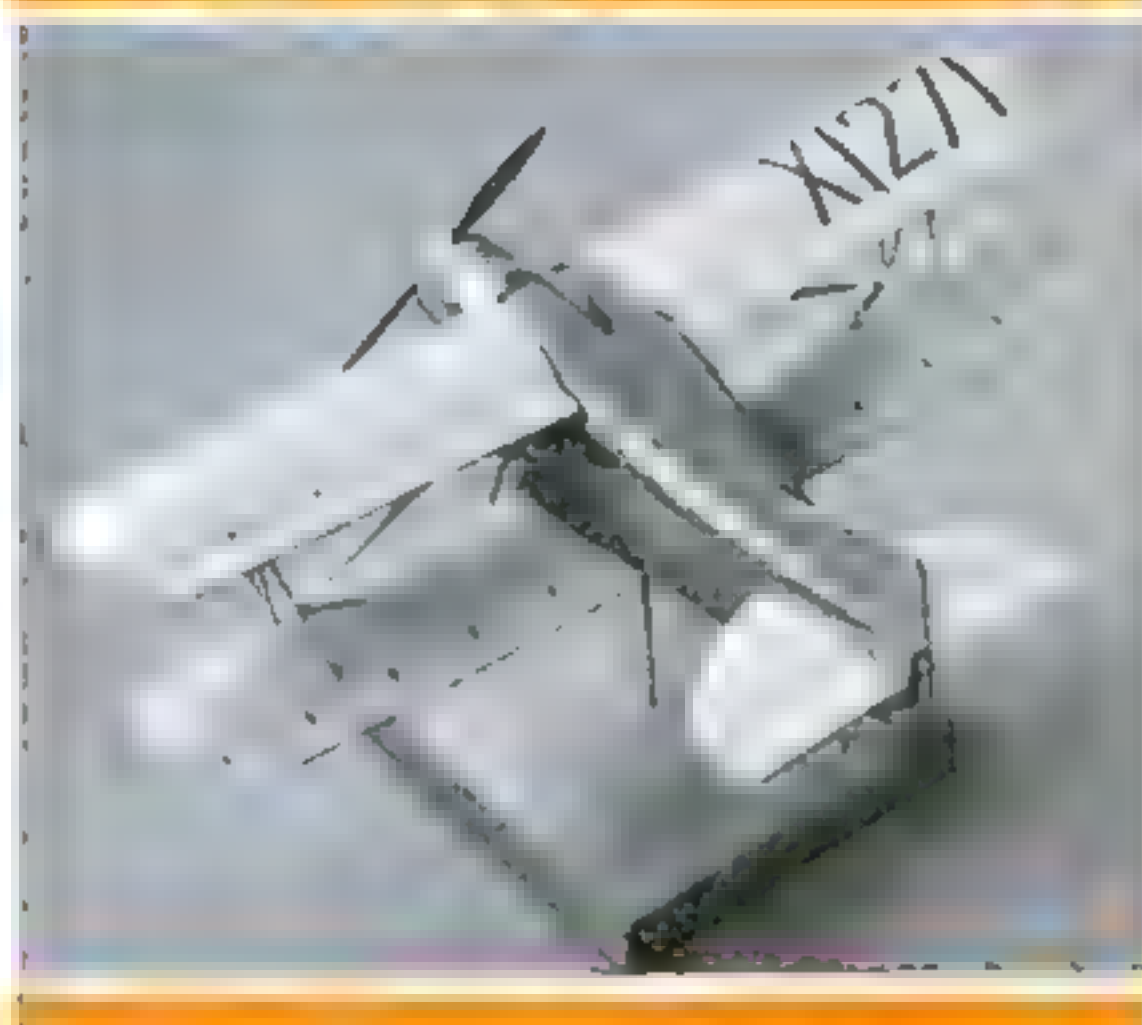
By
DONALD
W.
CLARK

AIRCAR

...a simply built scale model of a novel two-place biplane



The wings are attached to the fuselage with pins. Right, the completed model, which has a wing spread of 9 in. and a 5 1/4-in. fuselage



cement of a type that will stick to both wood and metal. The pins that support the horizontal tail will also hold the vertical tail in place. Indicate the streamline hinge with a gob of glue.

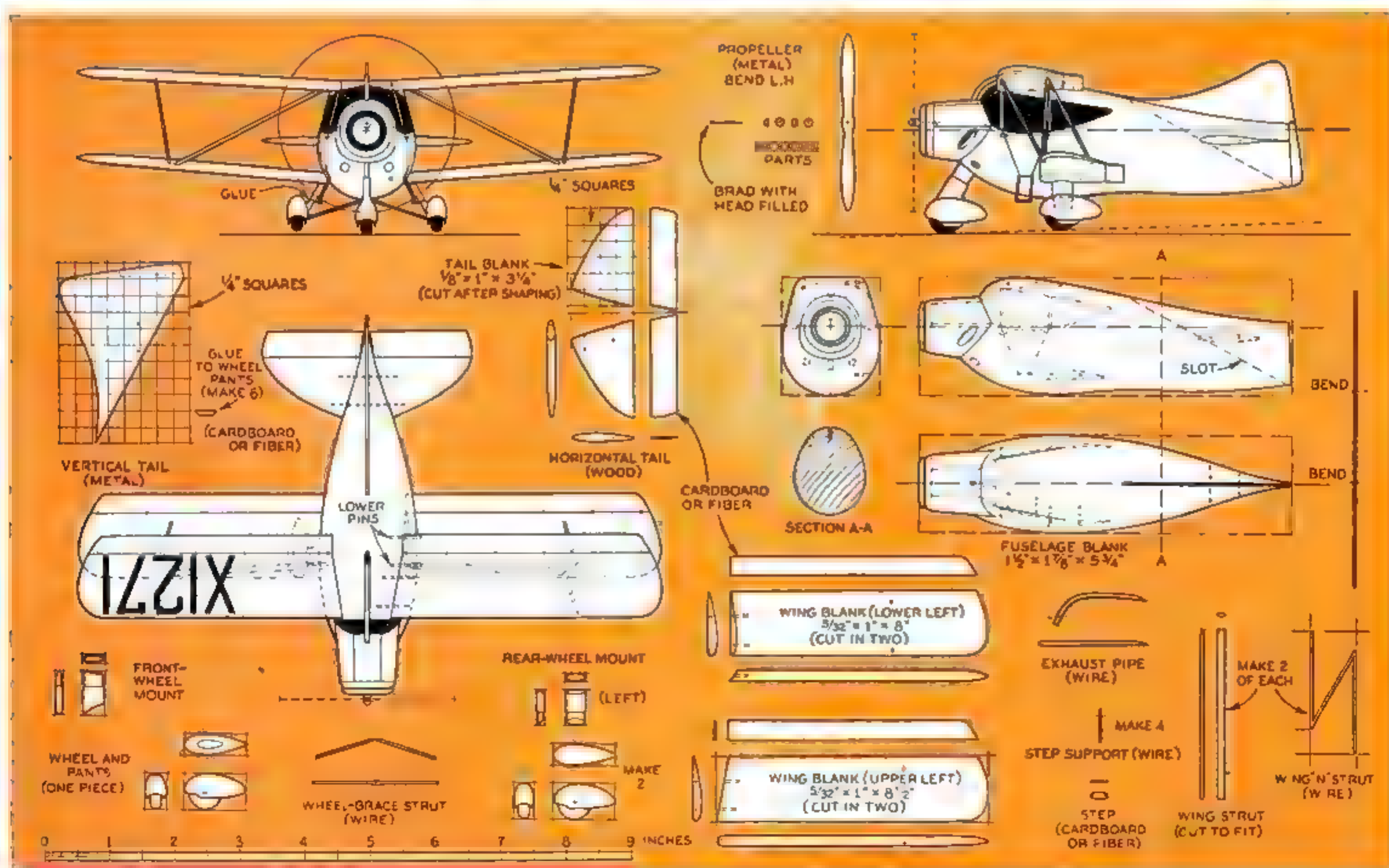
The colors for the model are as follows: dark blue fuselage, landing gear and vertical tail; light gray wings, horizontal tail, and propeller; black windows and details.

The specifications of the Aircar itself are:

IN THE light plane field, an unusually attractive design for model makers is the new Gwinn Aircar, a two-place cabin biplane with tricycle landing gear and automobile-type controls. It was developed primarily to meet the demand for a low-cost, easy-to-fly airplane for private use.

Forty pieces are required to build this 1/8-in. scale model of the plane. The wings are made of wood with cardboard or fiber flaps glued to the rear edges. You will note that the upper wings have a decided negative angle of incidence. Cut pockets to take the ends of the N-struts, which should be set in

span, 24 ft.; height, 6 ft. 10 in.; length, 16 ft. 3 in.; weight empty, 1,025 lb.; useful load, 555 lb.; engine, Pobjoy "Niagara" II, 90 h.p., geared. Performance: maximum speed, 120 m.p.h.; cruising speed, 109 m.p.h.; cruising range, 495 miles; service ceiling, 10,000 ft.; landing speed, 49 m.p.h.



Front, side, and top assembly views, and details of the fuselage, wings, vertical and horizontal tail, and other parts. Note the inch scale



Official Magazine
POPULAR SCIENCE
MONTHLY

Early arrivals at a meeting of the Lakeside Homeworkshop Club, Muskegon, Mich., start to work on their projects while waiting for the business session



Home Workshop Clubs Pave Way TO BETTER CRAFTSMANSHIP

Left, Charles Schinke demonstrates uses of the bench saw for members of the home workshop club in Fairmont, W. Va.

Projects of the New Bedford (Mass.) Woodcraft Club which won first prizes at the local Y.M.C.A. hobby exhibit



WHEN busy in your home workshop, are you often confronted with problems difficult to solve? Can you cut a good rabbeted joint with a circular saw? Can you glue a chair together so it will hold a lifetime? Do you know how to care for shop tools, and the correct way to use them? You can probably find the answers to these and other problems in books and magazines, or by the tedious trial-and-error method, but the easiest way is to join a club affiliated with the National Homeworkshop Guild.

A musician must practice systematically for years before he becomes proficient, but this need not be true of the home workshop hobby. Home workshop clubs are composed of men like your-

self (and some women, too) who want to improve their craftsmanship and get the most enjoyment out of it. As clubs, the members can obtain the services of experts who will give lectures, demonstrations, and advice. The clubs also provide an opportunity for the exchange of ideas, and the beginner is able to benefit by the critical judgment of more experienced amateur craftsmen.

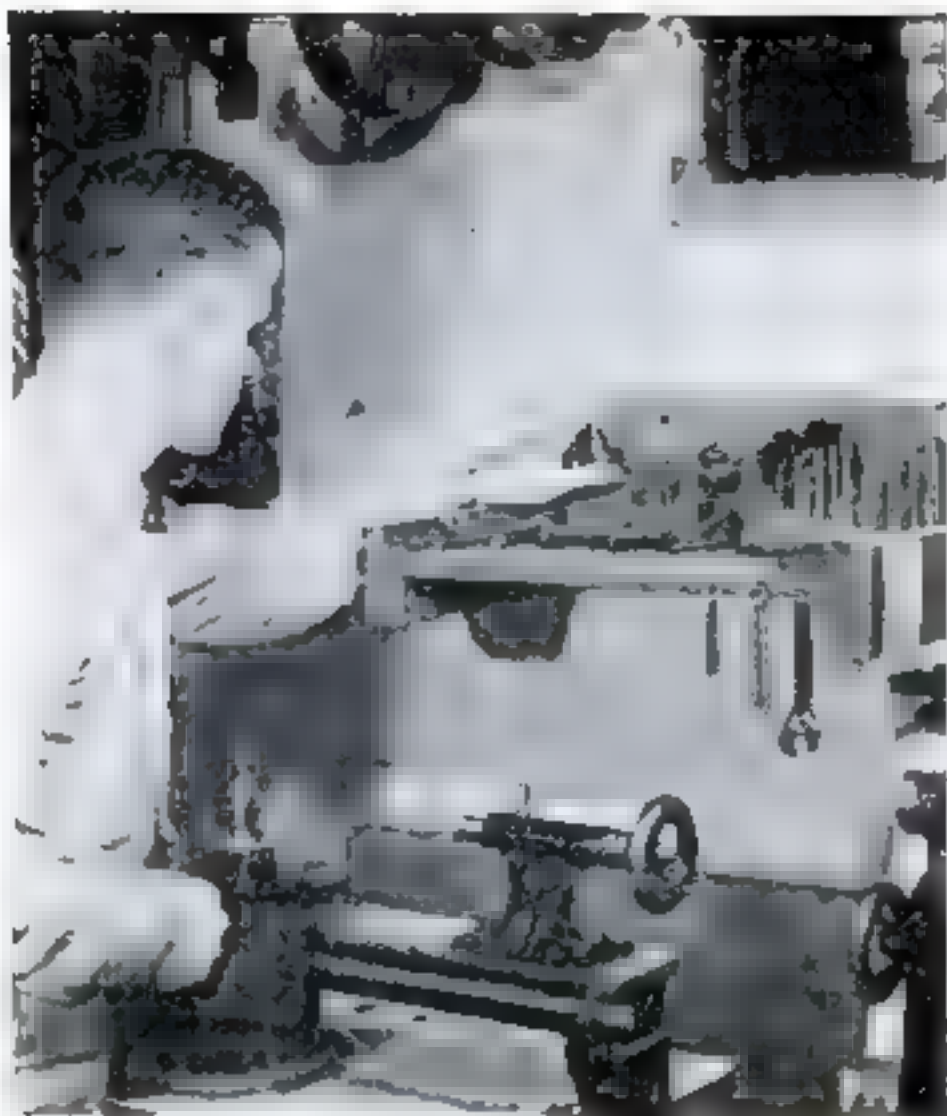
In a period covering only three months the Lakeside Homeworkshop Club of Muskegon, Mich., for instance,

arranged talks and demonstrations on the following subjects: wood finishing, wood turning, uses of the circular saw, archery, interior decorating, period furniture, home workshop hints, and lay-out work.

An even more varied series of programs has been enjoyed by the Union County Craftsman's Guild of Elizabeth, N. J. There have been demonstrations of glue uses, tool sharpening, and varnish; illustrated lecture on abrasives, visits to the Thomas Edison Vocational School and a silver-plating shop, lecture on wood finishing, talk by the president of the New Jersey Crime Detection Bureau, and moving pictures.

A complete workshop was set up at a meeting of the Town Hall Homeworkshop Club, Ottawa, Ill., and a talk given on "The Value of a Hobby." A demonstration of the drill press followed. Forty men attended and eleven new members were signed up.

The Brunswick (Me.) Homeworkshop Club had talking moving pictures at a recent meeting. Officers for this year are S. N. Francis, president; William Sparks, vice president; W. A. Duquette, secretary-treasurer . . . Robert Howard was host to the LeRoy (N. Y.) Homeworkshop Club in the enlarged industrial arts shop of LeRoy High School. Plans were discussed for the club's third annual display contest . . . Norwood Teague, of the Kemp Homeworkshop Club, Goldsboro, N. C., has made a jig saw out of an old sewing machine which uses band-saw blades . . . Easter toys for poor children were made by the Bison Builders Club of Buffalo, N. Y. . . . T. E. Stepan demonstrated how to glue a joint with hot glue at a meeting of the Vicksburg (Miss.) Homeworkshop Club held at his home . . . The Eddy and (Continued on page 88)



Rack Specially Built to Hold Lathe Tools

CONVENIENTLY arranged tools are an incentive to good workmanship. A shelf made from scrap lumber as shown is a handy place for all lathe tools, wrenches, chucks, and other accessories. If possible, construct it so that it projects from the wall right up to and almost over the top of the lathe.

Be sure to note the slanting block at the back of the shelf on which the chucks and centers are mounted. Your work will be speeded up considerably because you will no longer have to search for mislaid tools.—E. E.

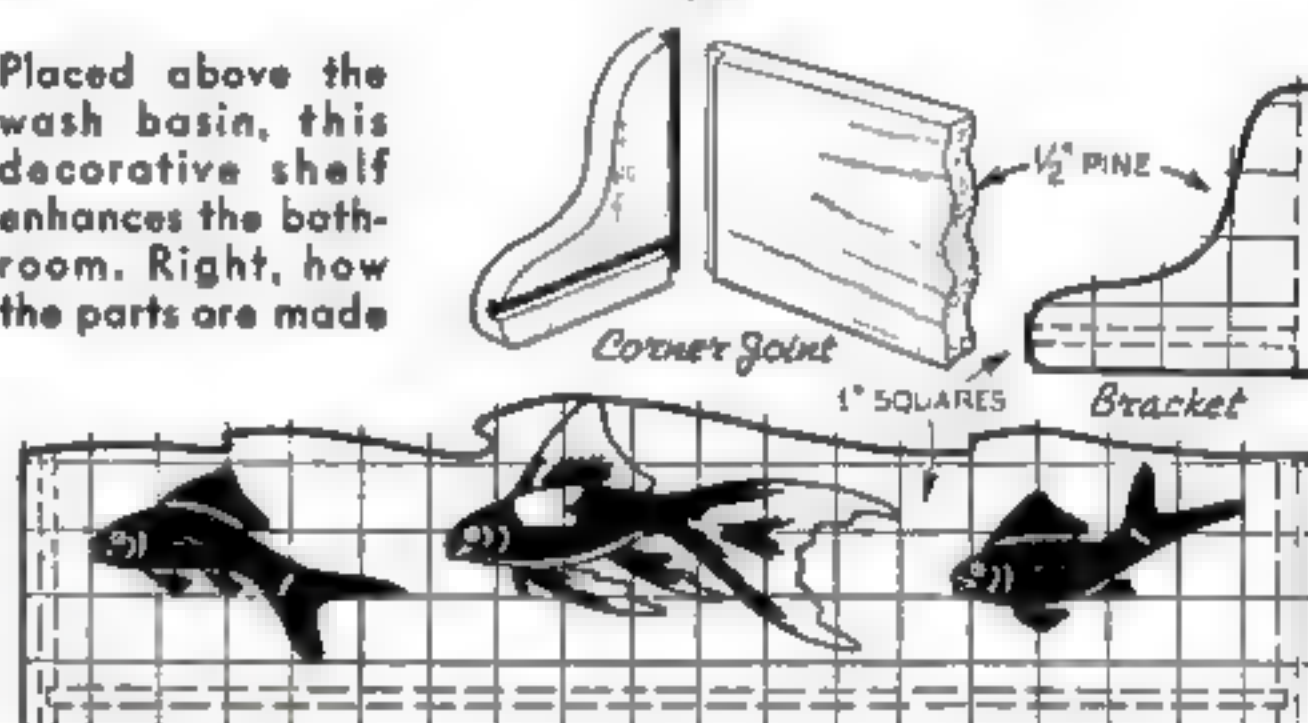
Ornamental Glass Shelf for the Bathroom

A DECORATIVE glass shelf for the bathroom can be made from a piece of plate glass 4 by 19 in. and three pieces of $\frac{1}{2}$ -in. pine. Enlarge the patterns to full size and cut the two brackets and back panel. Cut the groove in the brackets so it will be a tight fit for the glass. Paint the panel background blue-green, the fish orange and white, and add a few wavy white lines, as shown in the illustration at the right, to give motion to the water. You can, of course, use different colors if those suggested clash with the present color scheme of the room.

The front edge of the glass must be polished smooth to prevent injury. If the shelf is placed in the grooves immediately after the wooden parts have been painted, the paint when dry will hold the glass securely with moisture-proof joints.—HAZEL F. SHOWALTER.



Placed above the wash basin, this decorative shelf enhances the bathroom. Right, how the parts are made



Carrier Aids in Gathering Stunted Crops

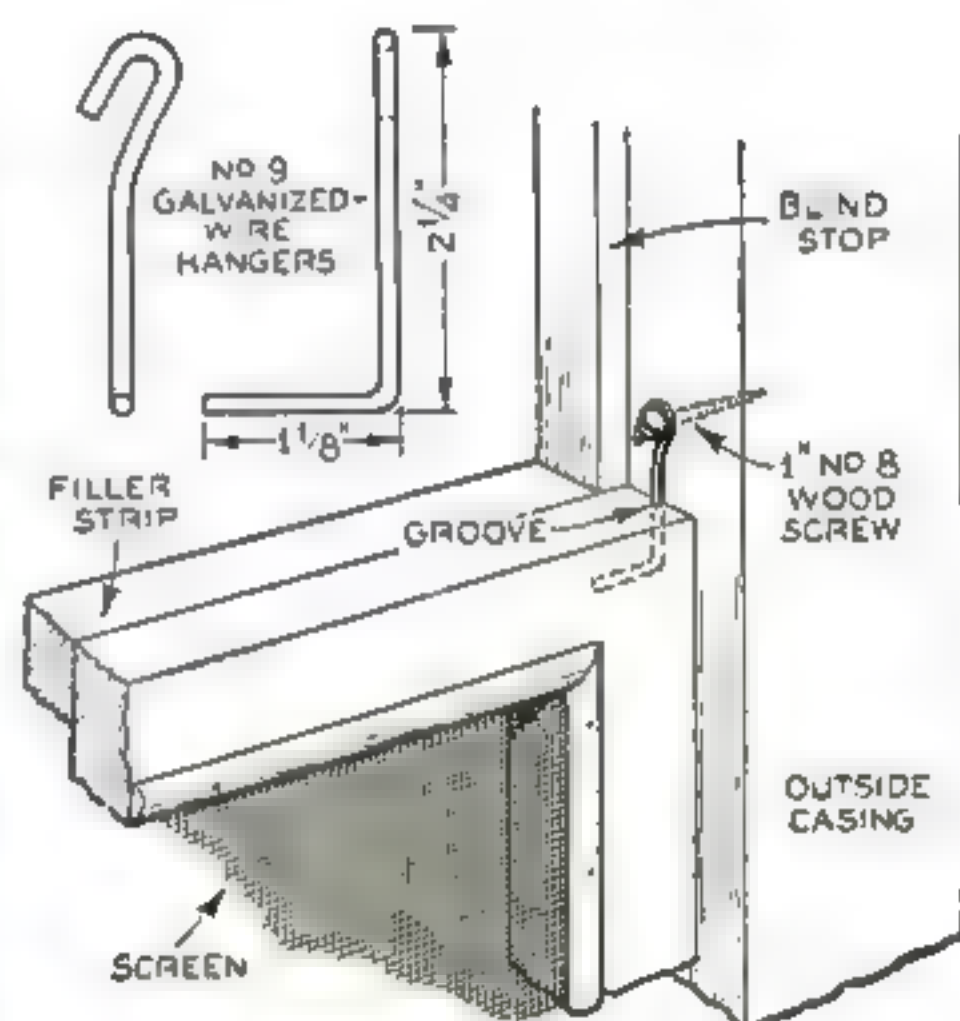
IN FARMING areas badly affected by drought, where crops have withered under the blazing heat of the sun, it is often necessary to gather for stock feed whatever grain is left. This work may be made easier by rigging up a carrier like the one illustrated, which is attached to a 4-ft. mower. A sheet of galvanized iron 5 ft. square is turned up 6 in. on each side and fastened to the cutter bar with four small bolts through a piece of strap iron, which holds it from beneath.

A rake, in this case made of a willow handle wedged into a wooden bar and braced with wire, is used to pull back the grain as it falls. When the carrier is full, the hay may be raked off in bunches and collected later whenever convenient.—NORVAL WRIGHT.



Galvanized iron attached to the mower acts as a carrier. Note that sides are turned up about 6 in.

As the hay falls onto the metal tray, it is pulled back from the knife and cutter bar as shown at the left



Foolproof Way to Hang Half Window Screens

HALF screens are frequently fitted on the outside between the blind stops of windows so that they slide up and down, but they are likely to become stuck either with paint or from swelling. To avoid this, they may be hung between the outside casings by using wire hooks made from No. 9 galvanized wire, as shown. Shim the screen up about $\frac{1}{16}$ in. before driving the wood screw on each side. The space between the blind stops is filled with a square strip tacked fast to the screen. The lower end is fastened by a $1\frac{1}{2}$ -in. hook and eye. To remove, simply unfasten the hook, push the screen out a few inches, and lift it off the screws.—H. N. ROWLAND.

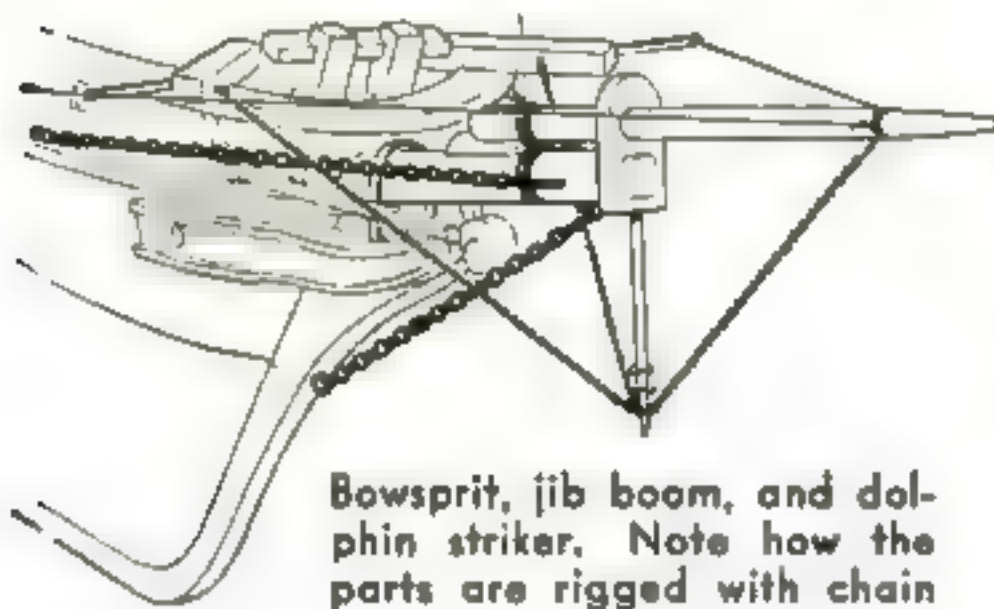


Rigging the 'ALABAMA'

THERE is no word that exactly fits the rig of our new ship model, the *Alabama*.^{*} Officially rated as a bark, she was really more nearly a topsail schooner. She would lie very close to the wind and maneuver handily. Her speed, independent of the engines, was from 10 to 12 knots; with engines, up to 15 knots.

Black fishline may be used for the standing rigging if you prefer, and, in fact, is advisable unless you have had previous experience in ship model making. The original ship, however, had Swedish iron wire standing rigging, so

^{*}This is the sixth in a series of articles telling how to make a scale model of the famous Confederate commerce raider.



Bowsprit, jib boom, and dolphin striker. Note how the parts are rigged with chain

MATERIALS FOR RIGGING

Deadeyes: $\frac{1}{8}$ in., 48; $\frac{5}{32}$ in., 72.
Blocks: $\frac{3}{32}$ in., 91 single, 26 double;
 $\frac{1}{8}$ in., 37 single, 8 double; $\frac{5}{32}$ in.,
32 single, 5 double; $\frac{3}{16}$ in., 9 single,
3 double.
21 small glass beads.
Black chain: 16 links to the inch, 14 in.;
22-link, 40 in.; 26-link, 12 in.
Rigging line (in feet):

	a	b	c	d	e
wire*	—	21	6	48	—
brown cord	12	80	20	4	3
black cord	—	32	—	3	—

*Captain McCann used galvanized-iron sash-cord wire, which he unwound. Black cord is easier to use and may be substituted.
Spool No. 100 sewing cotton or size-A silk for ratlines.
1 ft. heavy cord for gun breeching.
Sailcloth 18 by 24 in. Three flags.

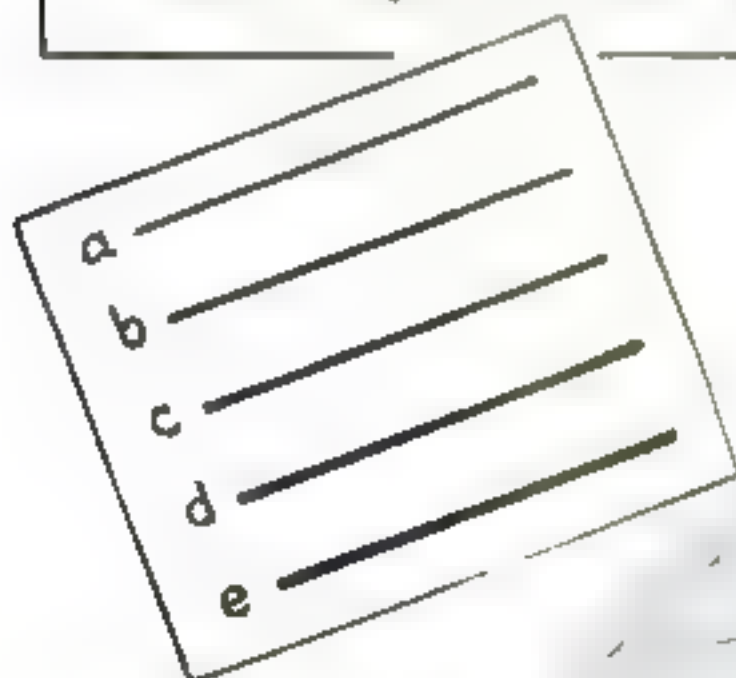


Diagram showing actual thickness of the five sizes of line required. Standing rigging is black; running rigging, all brown

I rigged my model with wire. This is a far more tricky job because the wire has no stretch, yet it must be quite tight. All shrouds and backstays must therefore have their deadeyes turned in at the exact height. Of course, once up, the fact that the wire does not stretch has the great advantage that the rigging does not give and take with changes in the weather.

Galvanized-iron sash-cord wire is excellent for the purpose. This has six strands, one of which I used full size for the lower rigging. Then each strand has seven wires, which, divided into four and three and twisted up a bit more, serves for such as the topmast shrouds, topgallant and royal stays, and backstays. The strands must be well rubbed down and pulled through the fingers until they lie straight before any attempt is made to use them.

The deadeyes (and lanyards) are the same as for hemp rigging— $\frac{5}{32}$ and $\frac{1}{8}$ in. in diameter.

The lower deadeyes are wire strapped to lie close on the channels. The ends of the straps (chain plates) are flattened and drilled for two pins.

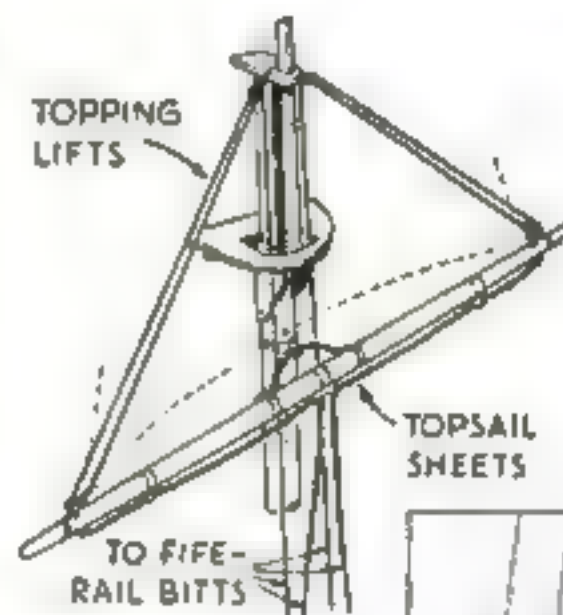
Ship the lowermasts and rig in the usual way. Seize a deadeye into the end of a cord (whether or not you use wire), pass the end up through the lubber hole on the starboard side, around the lowermast, and down. Seize

a deadeye in this end so that both deadeyes will lie just clear of the rail when brought down tight with the lanyards. Seize both parts of the shroud together under the top. Now do the same on the port side, and continue until all the shrouds are on.

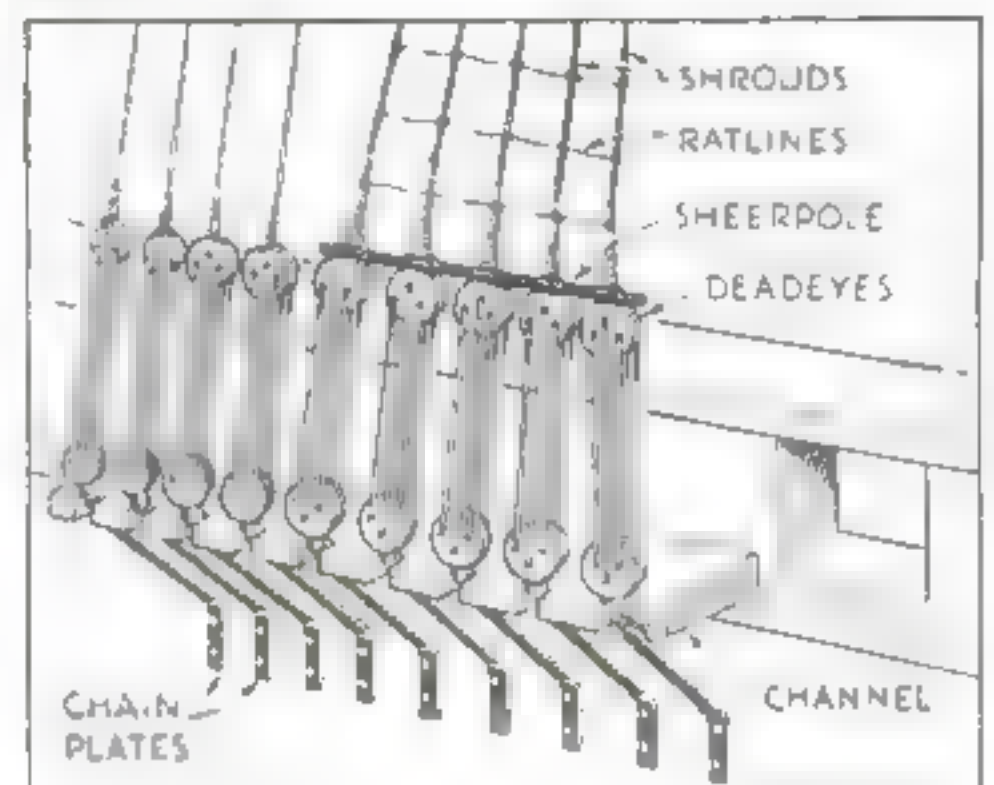
Sheerpoles are thin, stiff wires seized to the top of the deadeyes to prevent them from turning.

Before the ratlines are put on, the shrouds should be painted black. Lacquer is the best for this. Be careful not to spatter the deck.

Ratlines (steps) are clove-hitched to each shroud, $\frac{1}{8}$ in. apart. Use No. 100 sewing cotton or size-A silk.



At left is a sketch of the main lower yard to show the topsail sheets and topping lifts. Below, how deadeyes are set at mainmast



Partly rigged model. Captain McCann set fore-and-aft sails early because the fore and main trysails are hard to reach later

Model

By CAPT.
E. ARMITAGE
McCANN



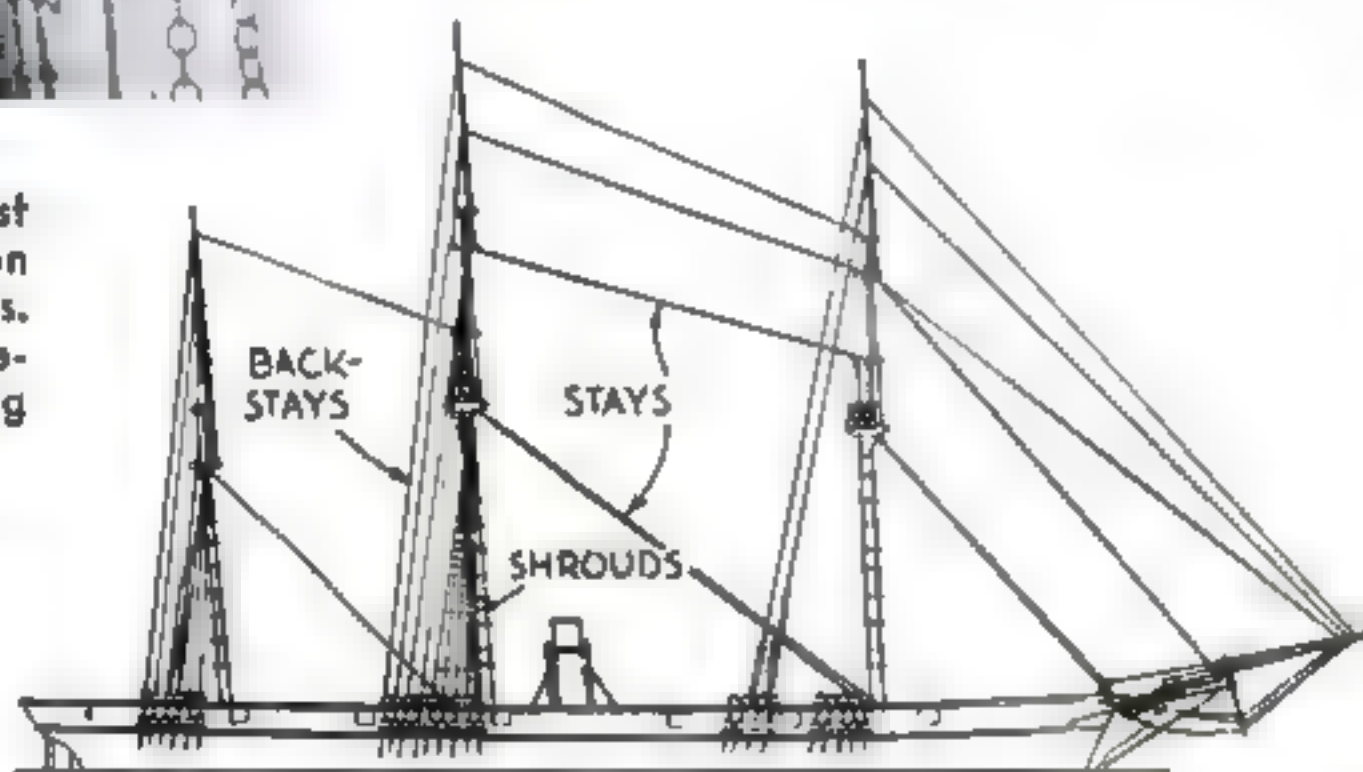
A close-up photo of mainmast top. There are three shrouds on each side, with 1/8-in. deadeyes. Sheerpoles and ratline are required as for the lower rigging

Stays are passed through the lubber holes, around the masthead, and down. Turn the ends back and seize to form eyes, and with lanyards bring these down to the eyes in the knightheads at the fore, and to eye-bolts in the deck for the mainstays. The mizzen stay is single, with a long eye around the masthead.

Ship the lower caps and the topmasts with their crosstrees. Pass the topmast shrouds and bring them down tight, using 1/8-in. deadeyes, three to a side. Give this rigging sheerpoles and ratlines as for the lower rigging.

Topmast backstays are passed similarly around the mastheads, one pair at each side. I used a full strand of wire and 5/32-in. deadeyes.

Topmast stays. The first, at the fore, is part of a strand, used double. It passes over the crosstrees and around



the masthead. The lower ends go over the cleats in the bowsprit and back to bolts in the bow, where they are drawn tight with lanyards.

The next stay, which is the inner jib stay, starts with a long eye at the masthead, goes through a hole in the jib boom, through an eye in the dolphin striker, to a bolt in the bow under the cathead. (This stay, of course, cannot be rigged until the jib boom and dolphin striker have been put in place as described a few paragraphs later on.) Small rings have to be rove on the stays for the jibs before reeving the stays through the jib boom. These rings are easily made by cutting a small chain apart at every other link



"Catting the anchor" of the "Alabama." In steady cadence, the sailors tread the deck to turn the heavy capstan—and the ship is off on another raid against Union commerce

and using the whole links on the stays.

The main topmast stay is single, with a long eye at the masthead. The end passes through a hole in the fore cap, and is turned back and seized.

At this point I thought it wise to set the fore and main trysails, because they are awkward to get at later. In fact, they would be correct if put on before any rigging, but as we have not yet described the sails, they may be left for the present.

Jib boom is rove through the cap, has its heel on the cleat, and is there lashed to the bowsprit.

Dolphin striker. This can be of wood up to 3/32 in. thick, but is better if made of 1/16-in. brass rod. The top end is filed to a point to stick into the cap. To the lower end are soldered three sets of double wire eyes. From the boom end a small chain is carried to the lowest eye. From the corresponding eye abaft, a double chain is taken aft, one end leading to each cathead, to which it is drawn very tight with lanyards. The other eyes are for the stays to lead through.

Whiskers take the place of the old-time spritsail boom to spread the boom guys. They are represented by stiff wires, flattened and nailed to the cathead, with (Continued on page 85)



When molding the pie-crust lip, a jig is placed under the wood to guide the shaping

THIS pie-crust table fits gracefully into almost any scheme of furnishings. The original was made of curly maple, although plain maple, mahogany, or other fine wood may be used.

The $\frac{3}{8}$ -in. curly-maple plywood top, the stock for the pie-crust lip, and the feet and leg may be obtained from a craftsman's supply house. Plain maple is available at most well-stocked lumberyards, but if it is used and the top is made a solid piece, the joints should be doweled.

Saw the top about 17 in. in diameter, draw a 16-in. circle, divide it into twelve uniform sectors, and mark a space of $1\frac{1}{2}$ in. at each division as shown at A.

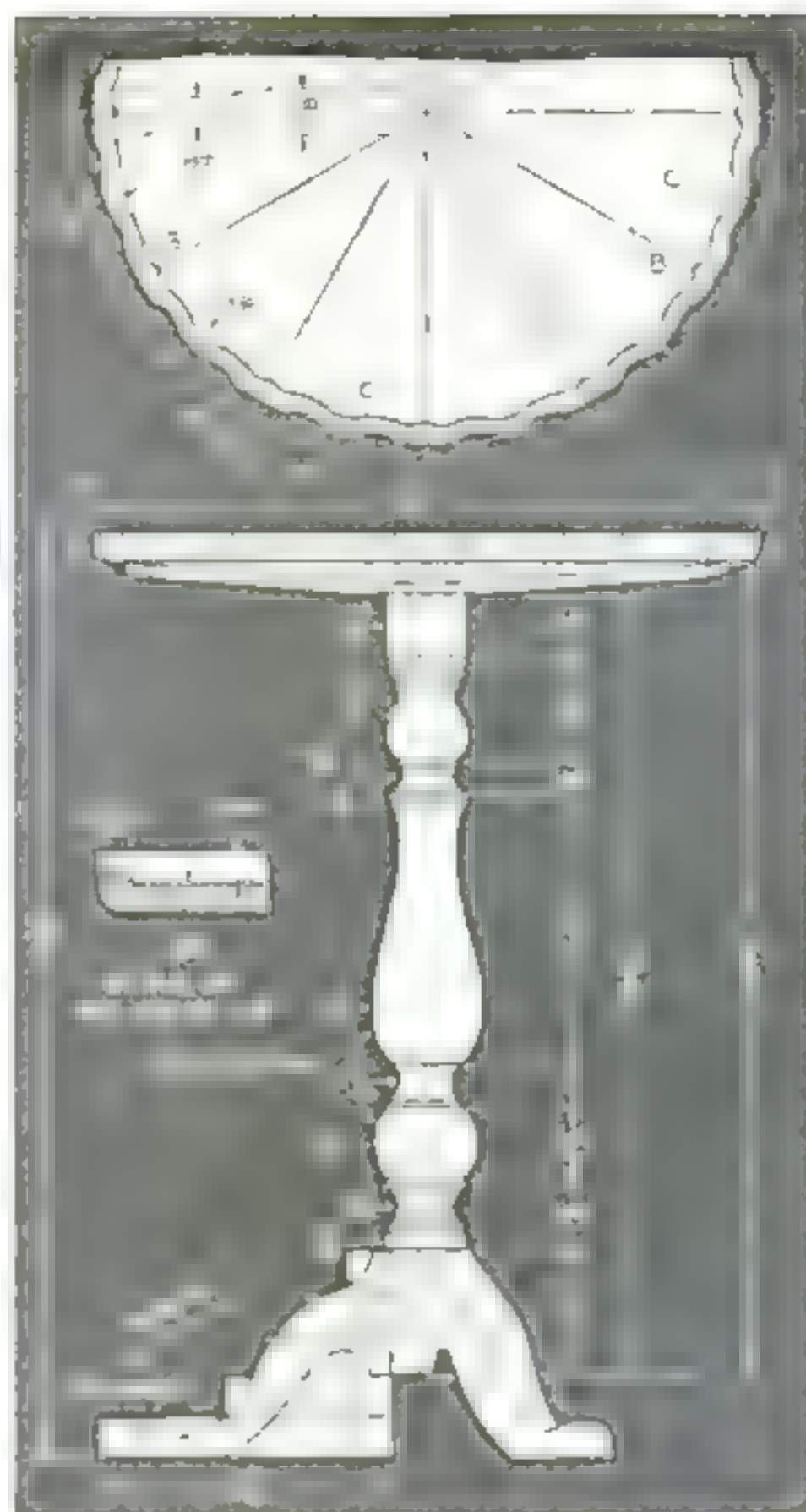
Make a wide template of hard pasteboard to include two full sectors plus 3 in. at each end or enough more than three sectors to allow for fitting. Fasten temporarily to the table top.

Continue through the template the 16-in. circle, draw circles $7\frac{1}{16}$ in. and $9\frac{1}{16}$ in. inside of it, and draw the pie-crust contour of the inner edge. Mark the $1\frac{1}{2}$ -in. spaces on the 16-in. circle; then draw the outside contours and a circle $\frac{1}{4}$ in. beyond. On this punch the centers of six holes indicating the centers of the pins shown in one of the photographs. These holes will be cut off when the top is band sawed to the finished size. Mark another circle $1\frac{1}{4}$ in. from the inner edge of the template, cut the template to that width, and shape the inner edge accurately.

Prepare a jig as shown in the same photograph, preferably from quarter-grained maple, $\frac{1}{2}$ in. thick and at least 2 in. wide. Mark the inner edge from the template and shape it carefully. Make the pins from $\frac{3}{8}$ -in. No. 9 or No. 10 screws.

Select straight $\frac{3}{8}$ -in. stock for the pie-crust lips and mark them in sets, right and left. Have the grain in each piece coincide closely with that of the table top where it is to rest. Roughly

THE SECRET OF SHAPING THE TOP OF A Pie-Crust Table



Jig with pins in place and a billet before it is finally trimmed. At left are the drawings

By
**CHARLES
A.
KING**

Made of selected curly maple, the table is enhanced by the delicately molded edging around the top

band-saw the contour of the inner edge to within about $\frac{1}{8}$ -in. of the line. Mark and drill holes to fit closely the pins in the jig. Then mold the lip pieces on the shaper as illustrated. The edge of the jig, which is under the stock, rides against the shaper collar and insures an accurate, uniform cut.

Locate point B on each sector radial line, fit each lip section so point B rests on its radial line and the curves coincide, and make the joints as at C. Place small brads so each piece may be easily removed and replaced.

Sandpaper the top, glue one lip in place, and then add the adjoining lips as the setting of the glue permits. Mark the outside line around the table, band-saw accurately, file the edge smooth, mold the underside, and sandpaper.

The remainder of the construction is of a familiar and conventional type. It is best to cut $\frac{3}{8}$ -in. dovetails in the feet to join the leg securely.

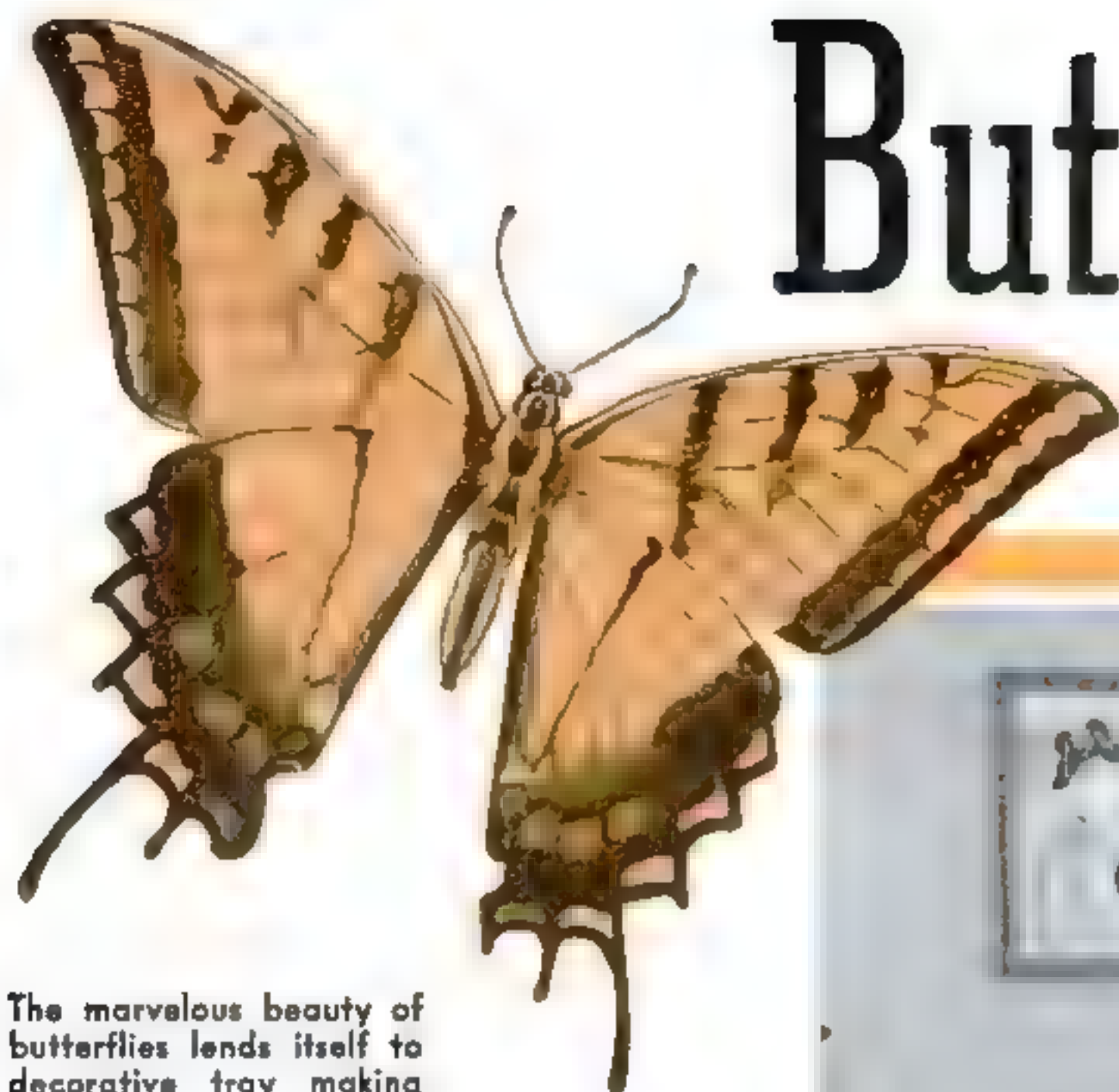
The finishing may be as described in previous articles on that subject, although the original table was very simply finished with a stain of boiled oil, turpentine, burnt umber, and japan, followed by three coats of shellac, well rubbed down. If the table is to be exposed to hot dishes or alcohol, a heat-resisting varnish may be used.



Shaping the foot with a sanding disk mounted in a drill press. Note the dovetail for joining to the pedestal

Butterfly Trays

By LEE M. KLINEFELTER



The marvelous beauty of butterflies lends itself to decorative tray making

THOSE flashing jewels of your garden, the butterflies, can be preserved for decorative purposes in the form of butterfly trays, pictures, furniture panels, and table tops.

First, you will need a cyanide jar into which to place the butterflies when caught. Since cyanide is a deadly poison, never to be handled or used without the most extreme caution, it is best to buy a prepared jar from a dealer in naturalists' supplies or have a local druggist make one up or obtain one for you.

Making a jar is, however, quite easy if you can obtain the cyanide. The usual method is to drop a few lumps of cyanide into a wide-mouthed, screw-top jar and add some cotton to keep them from rattling around. This layer is covered with a pasted-in disk of strong, perforated paper so the gas will escape into the remainder of the jar.

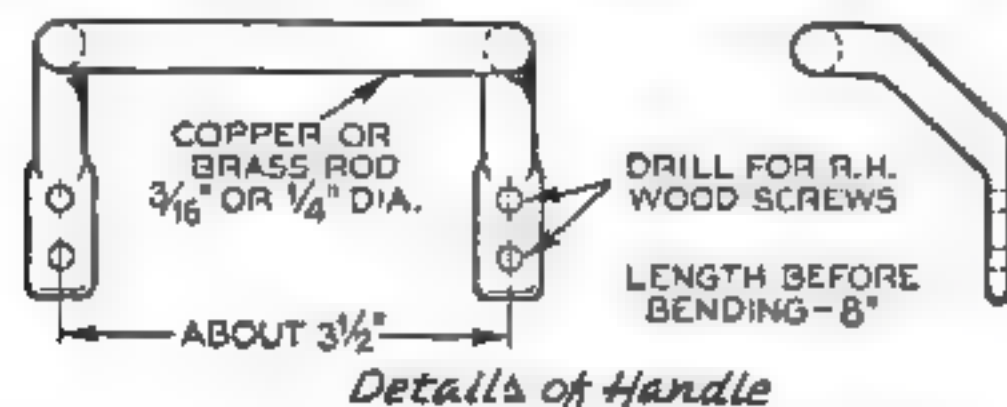
Another method, which the writer follows, is to put an ounce or so of either potassium or sodium cyanide in the bottom of a pint fruit jar and pour half an inch of plaster of Paris and water over it. Leave the jar open in the open air until the plaster dries; then put on the cover and leave it on because the cyanide is so very poisonous. The jar should always be kept tightly covered, both to conserve its strength and for safety. Of course, it should be conspicuously labeled and kept out of the reach of children.

To catch the butterflies, nail a hoop on the end of a stick and sew or tack on a piece of mosquito netting. When a butterfly has been captured, open the cyanide jar, thrust it into the net, mouth first, until you get it around the butterfly at the end of the net; and

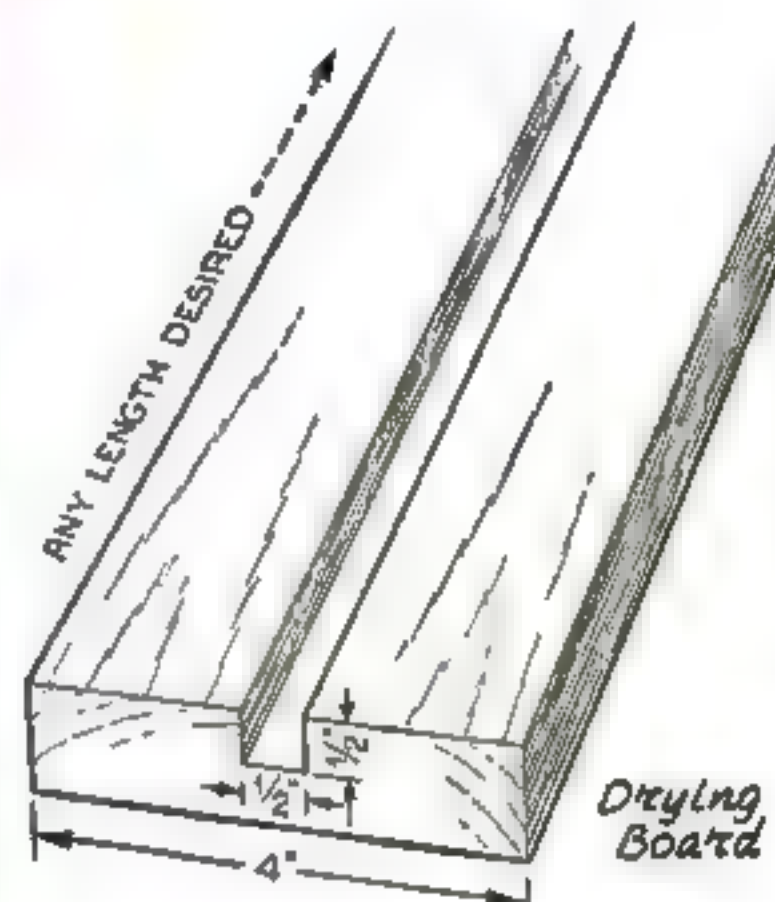
hold the cap tightly over it from the outside of the net until the butterfly is anesthetized. Then you can disentangle the net and replace the cap properly.

In handling butterflies, be careful not to touch their wings, for the tiny scales rub off easily, leaving little more than a skeleton.

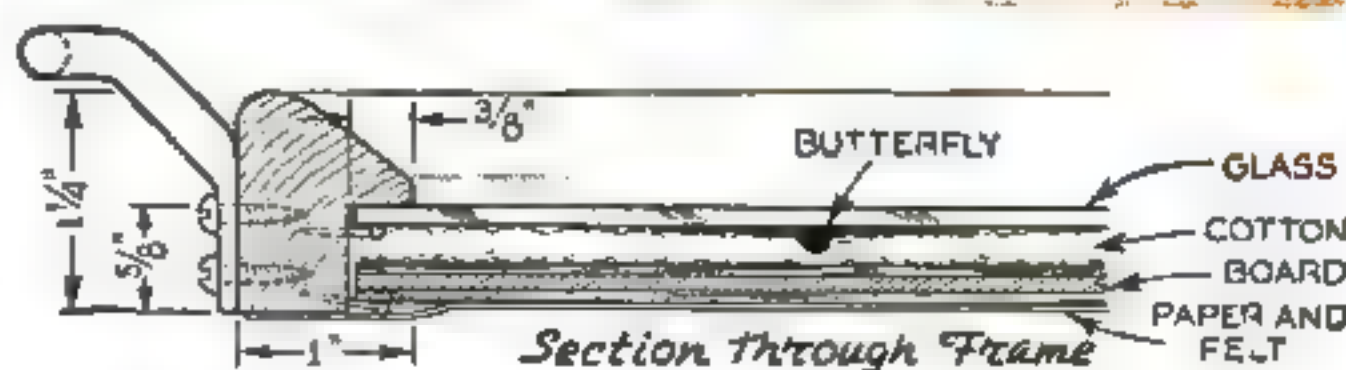
When removed from the jar in a half hour or more, the butterflies should be spread out on a drying board. This is best made from balsa, basswood, or white pine to take pins easily. A pin through the center of the body will hold the butterfly in place while the wings are spread out and pinned down. The wings, which should be brought well forward as shown in the photos, can



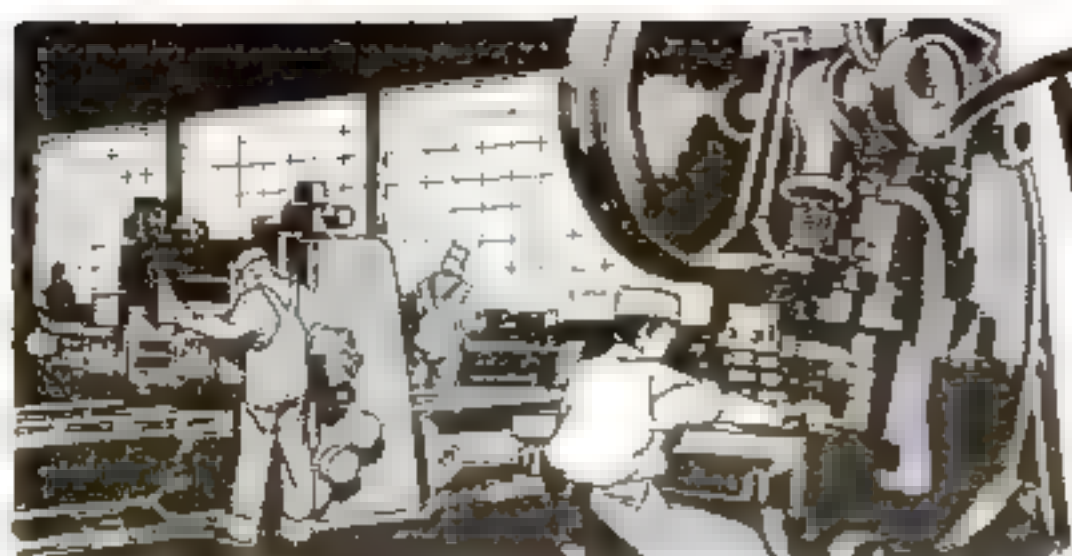
Tray handles may be purchased in a variety of styles or made from copper or brass rod



Left, a tray and a wall frame or picture. Above, a simple type of drying board. Below, spreading the butterfly wings



How the parts of the tray or frame are assembled. Note that the rabbet in the molding is extra deep to allow for the quilting cotton. Above, arranging the butterflies



Better SHOP Methods

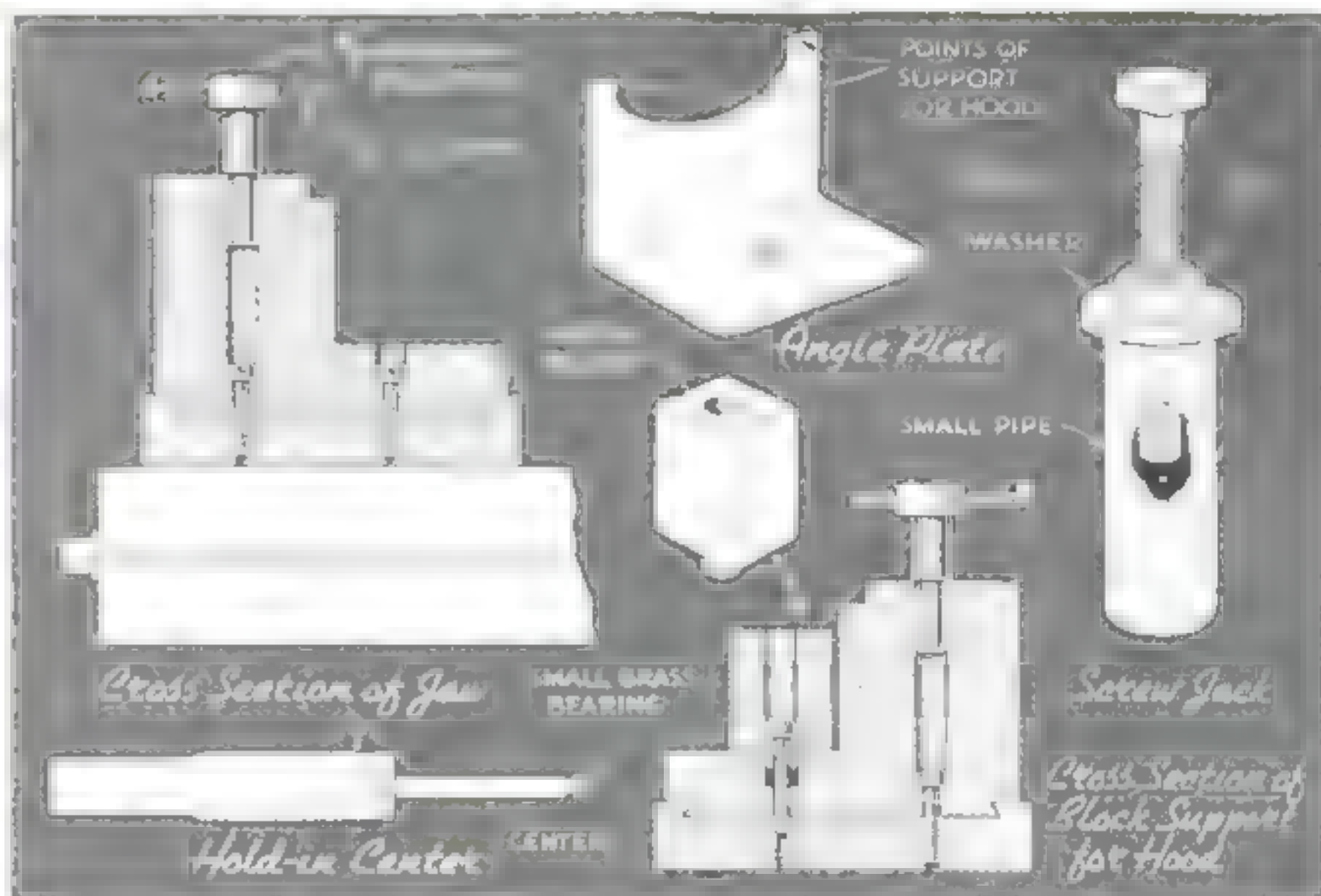
Machining Thin-Walled Hoods



Tightening the supplementary jaws. Note the small screw jack across the opening and the hold-in center

THIN-WALLED hoods and similar parts that are hard to chuck without springing them out of shape can be held for machining as shown. One end is placed on two points of an angle plate bolted to the chuck, while the third point of support is supplied by a small block of metal held fast upon the bottom extension of the chuck jaw opposite. Supplementary jaws

are then made from short $\frac{5}{8}$ -in. bolts, the ends of which are machined for $1\frac{1}{2}$ in. to slip snugly into the countersunk screw holes in the universal chuck jaws. The heads of the bolts are drilled and tapped for $\frac{1}{4}$ -in. machine screws. Insert a small screw jack across the open end of the hood, set the regular chuck jaws, and tighten the supplementary jaws with a screw driver. Use a long hold-in center with a small brass bearing.—O. R. S.



Precision Turning with Worn Lathe Chuck

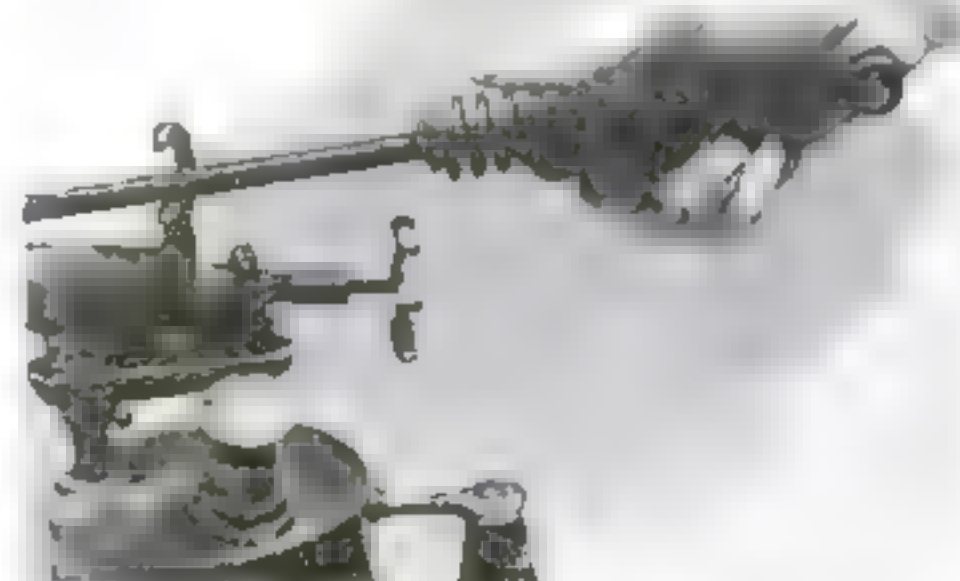
WHERE there is no allowance for truing a piece of small round stock, it can be held for precision turning as shown even if the chuck is considerably

worn. The steady rest is set up in the usual manner 6 or 8 in. from the face of the chuck, and a scrap of round stock 1 or $1\frac{1}{2}$ in. diameter is centered in the steady rest. The jaws are locked tight and a hole is drilled through the piece that will be a snug running fit for the stock. The bar to be machined is then run through the spindle, the chuck, and the hole, extending far enough to make the part desired.

For each new cut it is necessary only to release the chuck jaws, slide the stock ahead far enough to make the next part, and again lock the chuck. An occasional drop of oil on the stock where it passes through the piece in the steady rest will keep it from running hot and perhaps grabbing.—R. GERALD BULLARD.



A small round bar set up in the lathe so it will run true in spite of a slight wobble in the chuck jaws



Everlasting Handles Made from Springs

COOL, everlasting handles for soldering irons, stove-lid lifters, pokers, and the like can be made from old auto valve springs. The ends of the spring are either squeezed into a notch filed in the shank of the soldering iron or other device, or they are brazed in place on the shank.



After the pipe handle has been brazed to the socket of the wood chisel, it is set upright in the vise and a 1/2-in. thick end of solid bronze is built up to the diameter of the pipe



Reclaimed chisel with pipe handle and solid bronze end to take the hammer or mallet blow



Oxyacetylene Brazing Aids in Repairing Tools

MANY tools may be made or repaired by brazing with the oxyacetylene torch. If, for example, a special lathe tool is required, a piece of high-speed steel can quickly be brazed to a bar of mild steel. We save all the short ends of lathe bits in our shop for just such jobs.

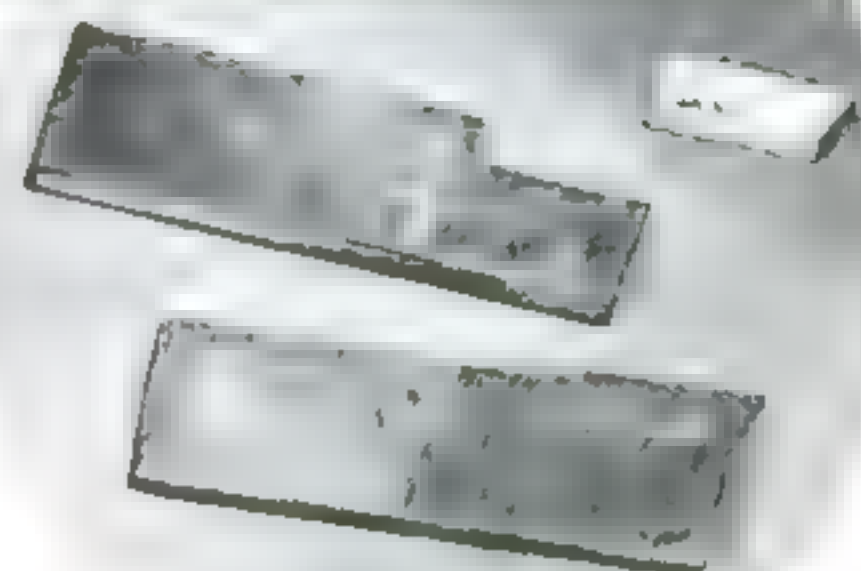
Drill a hole in the mild-steel holder or notch it as shown in the circle. Grind all sides of the bit until bright, set it in the hole or notch, and braze by keeping the flame mostly on the mild steel. Don't let the bit get more than a bright red. Use a bronze filler rod and a good flux, letting the flux melt over the joint before applying the rod.

After brazing, under no circumstances cool the tool in water. To do so would

ruin both the bit and the brazed joint. Allow it to cool in the air or a draft.

In the case of an old wood chisel, the socket of which has been so badly battered a new handle cannot be fitted into it, dress up the socket and cut a piece of black iron pipe about 4 in. long to slip over it. Braze the pipe to the socket, and then set the chisel upright as illustrated. Starting on the inside edge of the top, place a ridge of bronze around the pipe, continuing until the end is closed. Next build up 1/2 in. of solid bronze to the diameter of the pipe. When cool, dress off and smooth the end.

This handle will not damage a hammer or even a wooden mallet, and if you drop the chisel, it will strike handle



The mild-steel holder and high-speed steel bit. Above, how they are brazed together

first, saving the edge from damage.

Extra small boring bars can be made by cutting a slot in a piece of mild-steel rod, grinding a lathe bit, and brazing it in place.—W. C. CHENEY.

This is the second in a series of short articles on oxyacetylene brazing.



Press ready for use and, right, the ports. The heavy iron plates were cast from wood patterns

Hydraulic Jack Operates Small Shop Press

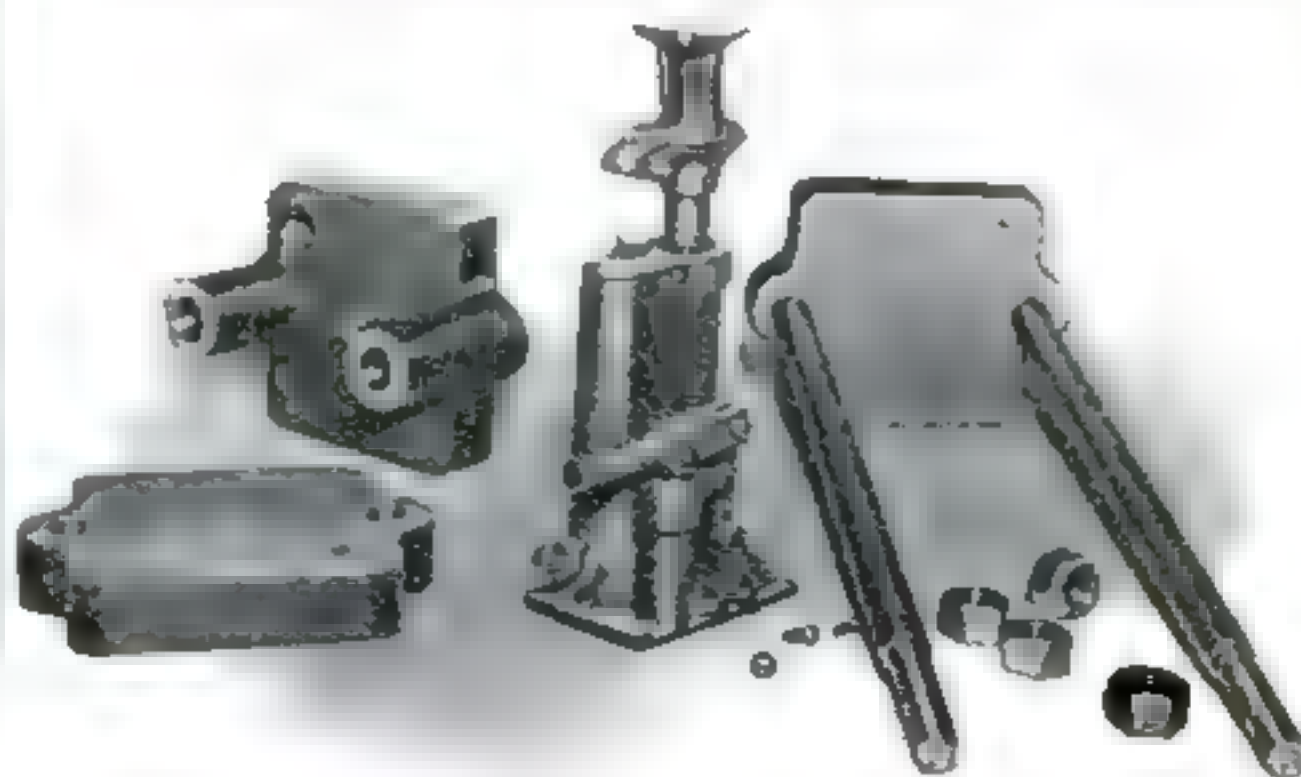
EXERTING a pressure of about 5,000 lb., this hydraulic press is useful for forcing bushings in and out, broaching, forming sheet metal, and other jobs in the shop. One of the new type oil-hydraulic automobile jacks is used for operating it.

Three iron die-shoe castings, 1 1/2 in. thick by 6 in. square, are required. They can be purchased from stock

at a large machine shop or you can make patterns and have them cast at a foundry. Note that the center casting has two bosses, whereas the top and bottom ones are flat.

The center casting is machined on the top surface, and the bosses are drilled and reamed to a sliding fit on the 1-in. diameter steel rods. The top casting is machined on the surface facing the center shoe and is bolted fast to the ends of the rods. These rods must be threaded on each end, and they are screwed into the bottom casting in holes bored and tapped to receive them.

The piston of the jack presses upward on the center casting. To release the pressure, the small valve on the jack is opened and the castings then come apart.—EARL S. ENSIGN.



Shading Furniture

WITH A SPRAY GUN

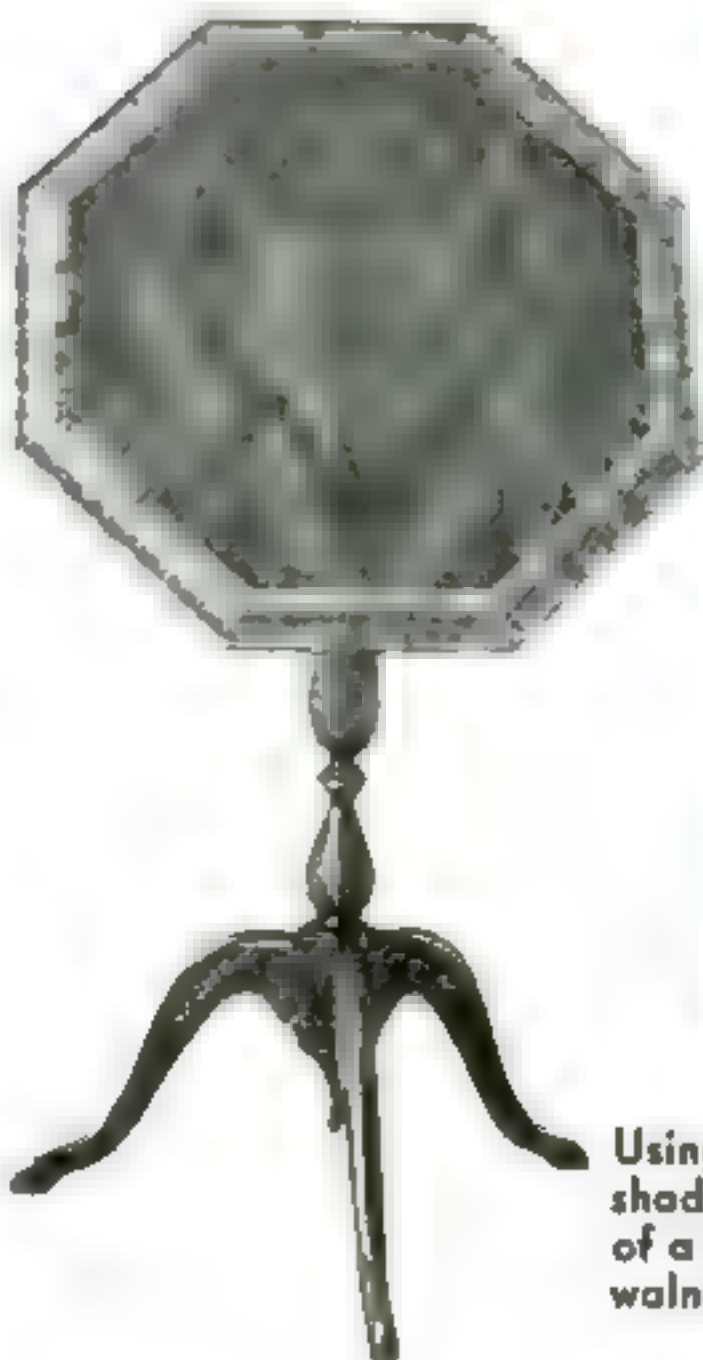
DELICATELY blended tones are obtained with the spray gun* on both the turned and flat surfaces of furniture and cabinetwork by what is known as "high lighting" or "shading."

The best method is to sand the initial stain coat when dry with No. 6/0 single-thick paper, moistened on the back to increase flexibility. The sanding is done wherever the natural contour of the design produces a shine or high light. Subsequently the stop lines left by sanding are softened with a sprayed stain coat applied as a moist fog from a distance from two to three times greater than normal. Then the usual sealer, filler, and finish coats are applied.

When a piece contains two woods of extreme contrast such as stump-cut black walnut and curly rock maple, staining alone is seldom sufficient to give complete harmony. The walnut is first carefully cut in with standard walnut water stain; and honey maple stain is applied on the maple with another brush. Before these coats are dry, some of the walnut stain is put in a cup-type touch-up gun and used as a shade coat to blend the areas lightly.

Lacquer shade coats may be used similarly to tone up or accent color values on work where the initial stain proves too light. This must be carefully done with a mist of color that permits

*This is the last of three articles on paint-spraying equipment and methods.



Using walnut stain to shade the light parts of a tip table made of walnut and curly maple

By RALPH G. WARING

the shade coat to dry almost instantly.

The following is a base formula for shade-coat material: 2 oz. oil-soluble dye, either walnut or mahogany, chosen for fastness to light; 3 pt. lacquer thinner; ½ pt. high-grade orange shellac; ½ pt. high-grade wood lacquer. Dissolve the stain in the thinner, add the shellac, then the lacquer. Let stand all day and strain through double cheesecloth before use. Keep in glass bottles.



HOW TO DIAGNOSE SPRAY-GUN TROUBLES

Jerky or fluttery spray. Caused by air leak. Look for loose air cap, loose fluid tip, clogged vent in cup lid, broken cup edge or gasket.

Excessive spray fog. Due to too much pressure for kind and viscosity of material.

Spatter. Too much material for capacity of gun, or dirty air cap.

Unbalanced spray. Dirty center orifice or air vent in cap.

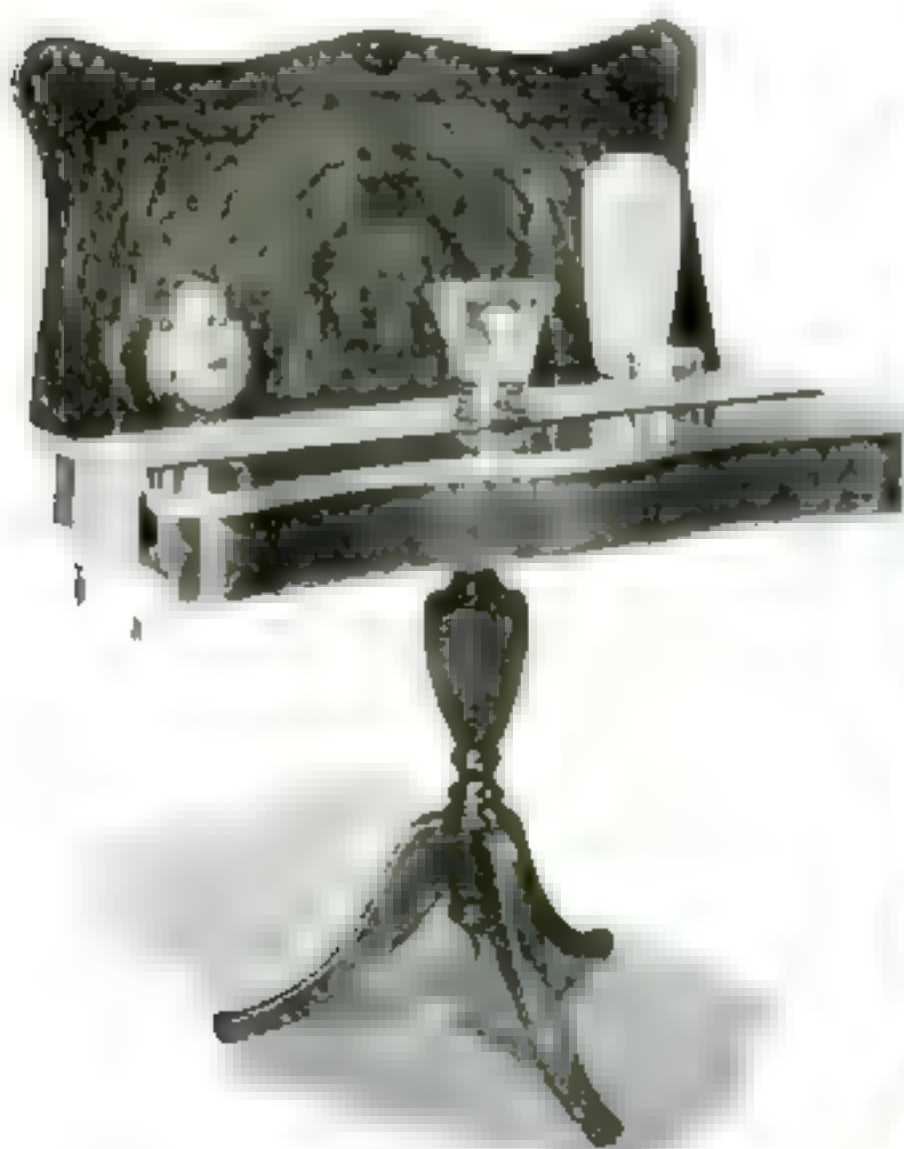
Split spray. Too much air pressure or too wide spray.

Oil or water spots. Transformer is not stripping, or hose is lying on a cold floor.

Other toning colors can be made in the same way from black, red, or yellow oil-soluble dyes; or an ounce of dye can be dissolved in a pint of lacquer thinner and used to tone up small portions of the base formula.

All shade coats should dry at least an hour before subsequent finish coats are applied.

Many spraying troubles may be traced to poorly cleaned guns. The gun should either be put into a closed pail of turpentine or lacquer thinner, depending upon the material used for spraying, or, better still, taken apart immediately, cleaned, blown out, oiled, and reassembled so it will be in first-class condition for the next job.



High-lighting the initial stain coat with No. 6/0 single-thick sandpaper, moistened on the back. The finished table, above, appears delicately shaded



Helpful Hints for Motorists

Door Guard Saves Car's Finish

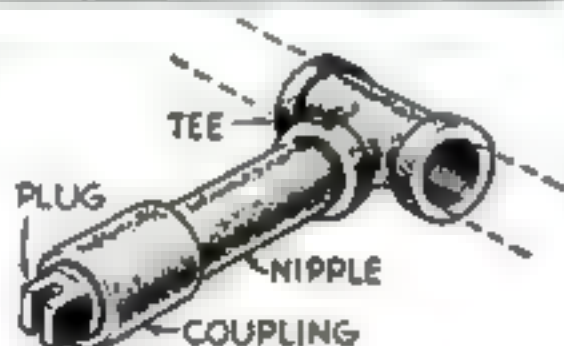
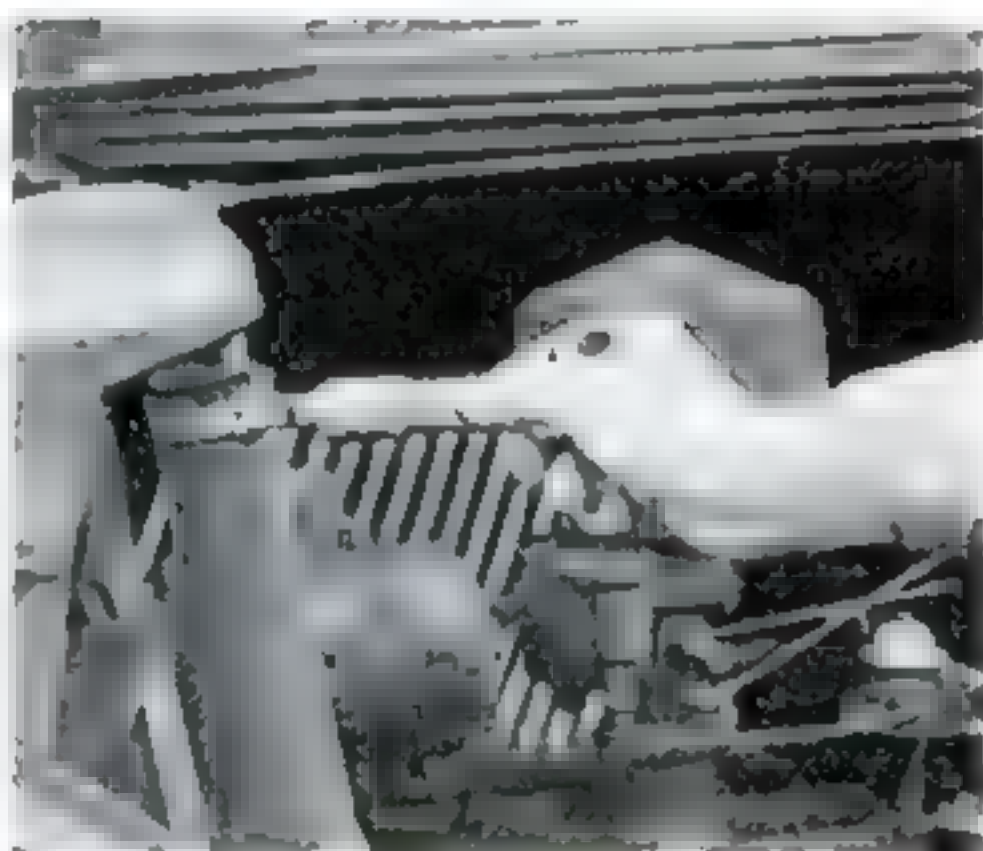
FOR those motorists who park their cars in crowded commercial garages where automobiles are packed in close together, simple guards that fit over the door handles will prevent body scratches and dents caused by the handles on adjacent cars whose doors are accidentally swung wide open. As illustrated at the right, the device consists merely of a length of plywood, notched toward the center so that it will hang from the door handles. The sides nearest the car body are fitted with a soft felt lining that may be held in place with rubber cement or household glue.—B. S.



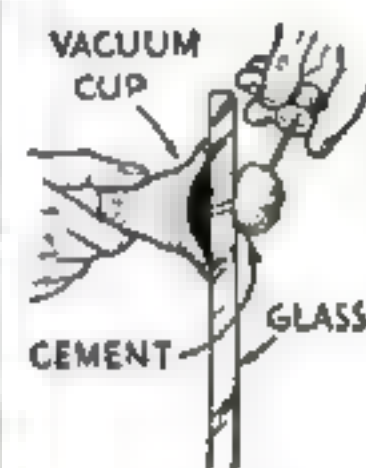
This guard will protect your car doors in crowded garages

Tool Turns Stubborn Thumbscrews

A TOOL that is superior to pliers for tightening rusted or jammed thumbscrews around a car can easily be made from a few half-inch pipe fittings. Assemble a tee, a three-inch nipple, and a coupling as shown in the diagram. Insert a plug in the coupling and make a wide notch in the square end with three hack-saw blades held in a frame at the same time. This notch will fit over the end of the thumbscrew firmly, making it easy to turn.—W. C.



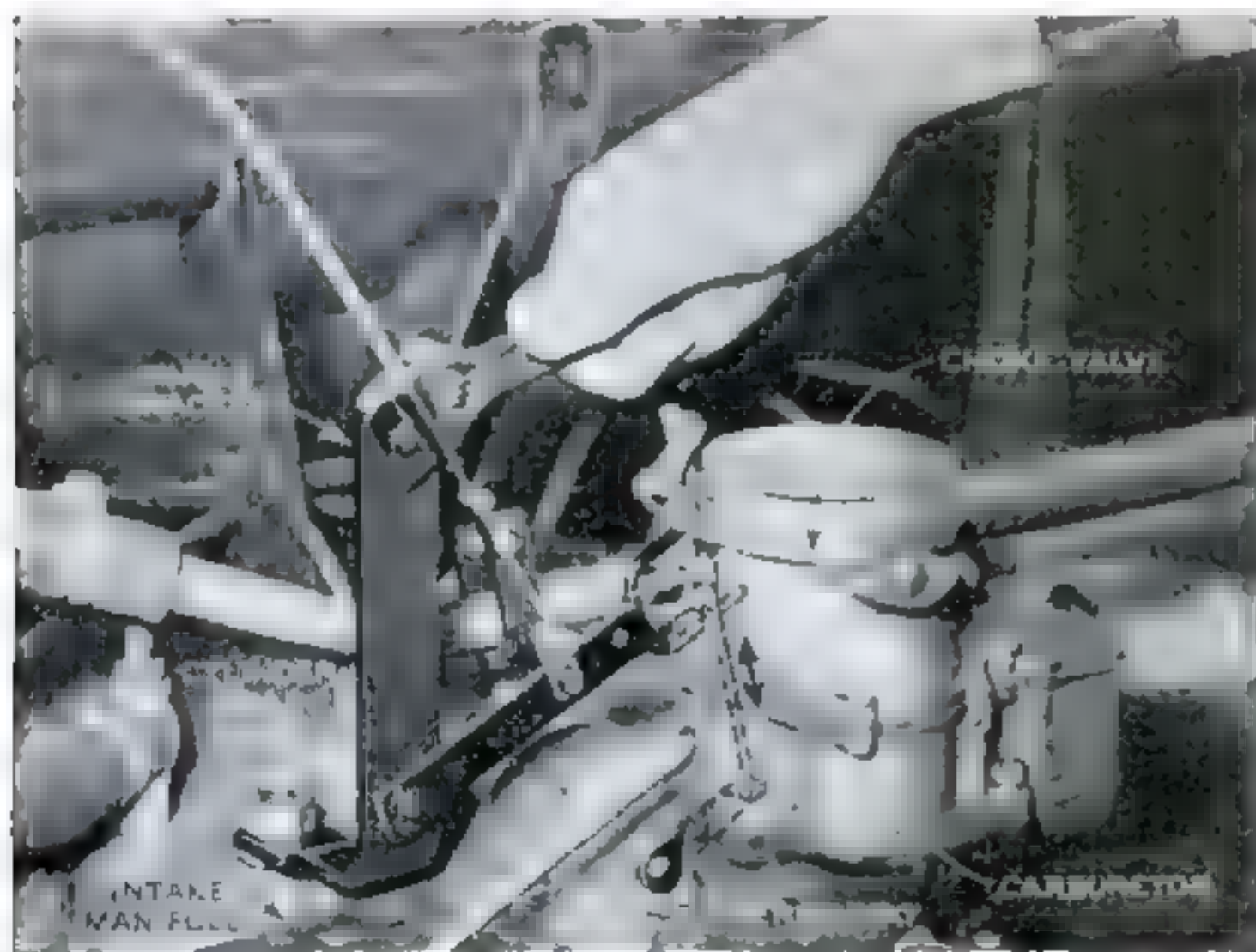
Suction Cup Aids Window Repair



How the suction cup is used to draw glue into a crack in window

WHEN applying cement to repair a cracked windshield or car window pane, it is generally a hard job to get the material inside the crack where it will mend the break firmly. I've found that a small suction cup is very effective for this purpose. Apply shellac or cement to one side of the crack and apply the vacuum cup to the opposite side. Pulling the cup away will suck the adhesive into the crack.—W. C. W.

Dash Control for Automatic Choke



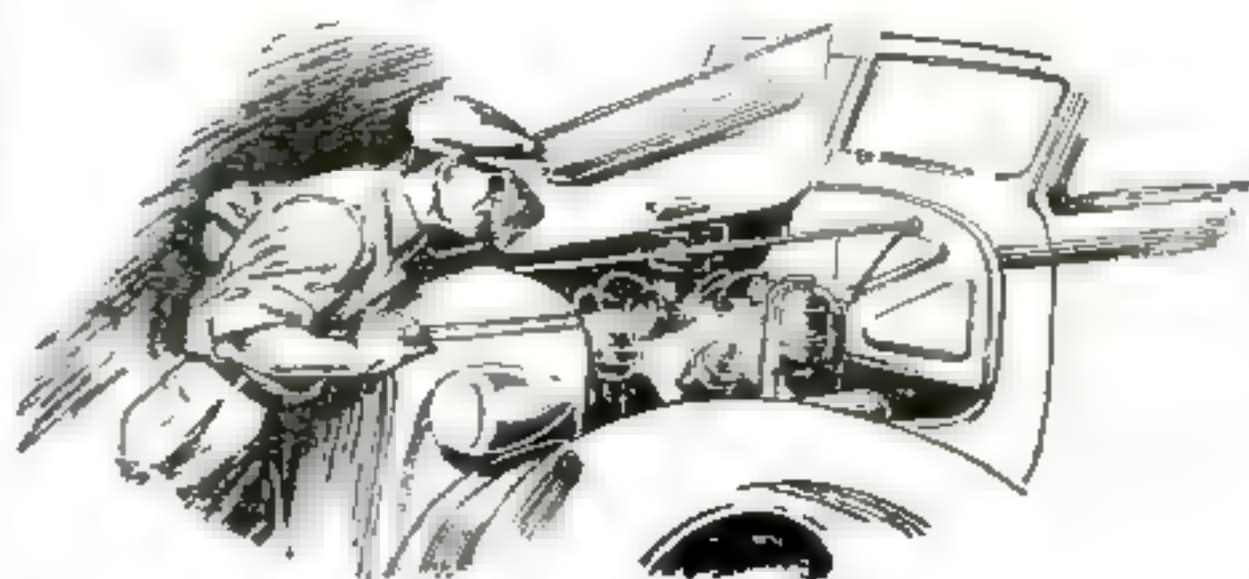
OWNERS of late-model cars who do not like an entirely automatic choke can install a hand-operated control so that choking can be either automatic or manual, as desired. The manual choke consists of a forked arm moved back and forth by a flexible-cable control, the prongs of the fork engaging a pin projecting from the rod that connects the automatic thermostatic spring with

the valve in the air-intake side of the carburetor. When the dash button on the flexible cable is pulled out, the valve closes, producing full choke. When the button is all the way in, the valve is completely open. When it is halfway out, the choke will work automatically, as if the hand control had not been installed. The driver thus has the choice of automatic or hand control.—W. E. B.

Rocking Your Car in Gear Opens Distributor Cam

Mounted on a bracket fastened to one of the head nuts, the choke control is worked by hand from the dash

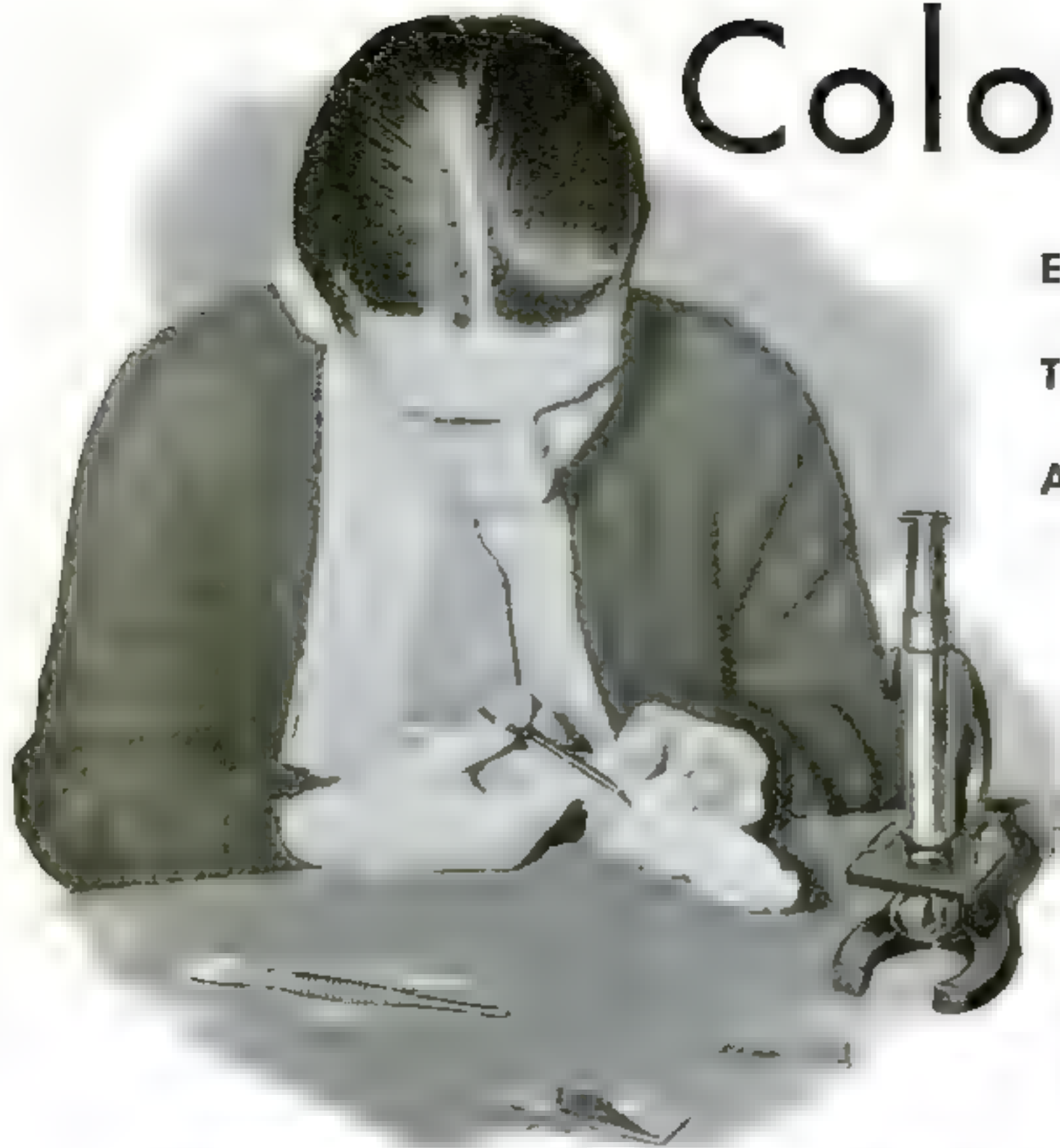
TO ROTATE the distributor breaker cam so that the contact points are at the maximum open position for adjustment, simply put the car in high gear and rock it gently until the gap is widest. It is better than hand cranking, because you don't have to remove the plugs to relieve compression.—P. F. R.



Colored Glasses

EASILY MADE LIGHT FILTERS CAN IMPROVE
THE PERFORMANCE OF YOUR MAGIC LENSES
AND REVEAL UNSUSPECTED WONDERS TO YOU

by MORTON C. WALLING



One of nature's engineering marvels, a chicken feather, being prepared for examination with the aid of light filters

AMONG the important microscope accessories, few that are readily available to the amateur will give him more return for his money or effort than a set of light filters. Easily made from inexpensive materials, or purchasable for a moderate sum, filters add fascinating color contrasts to the objects you place on your slides. They bring unsuspected powers to even the weakest lenses and, if your hobby is photomicrography, they make possible pictures that you never thought you could catch on a photographic film.

Several of the illustrations on these

pages show what filters can do to bring out details of the fascinating structure of feathers (P.S.M., June '35, p. 40) viewed and photographed under a microscope. Filters of different colors and degrees of translucence have varying effects on what your microscope shows you, and permit you to "hold back" certain things appearing on your slides, while emphasizing the clarity of other things.

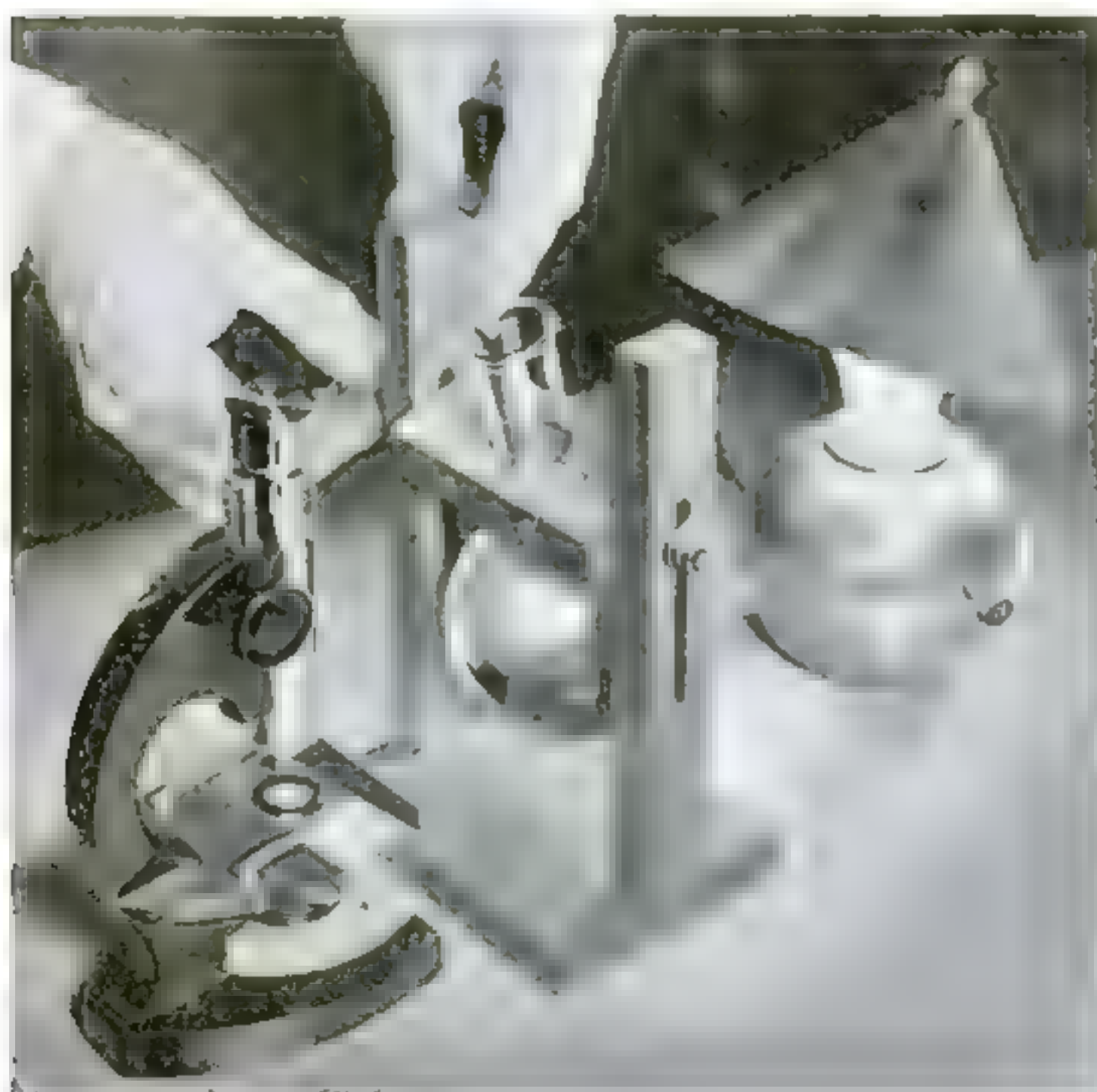
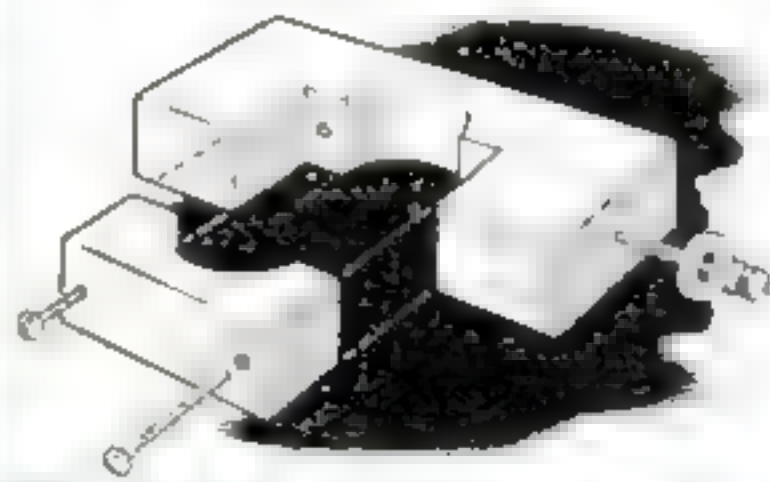
A filter of the kind the microscopist uses is simply a translucent, colored medium whose function is to absorb some wave lengths (colors) of light while it permits others to pass. Filters

are used, in visual observation and in photomicrography, for two main purposes. They make the microscope lenses perform better, and they control contrast between the object and its background or between different parts of the object.

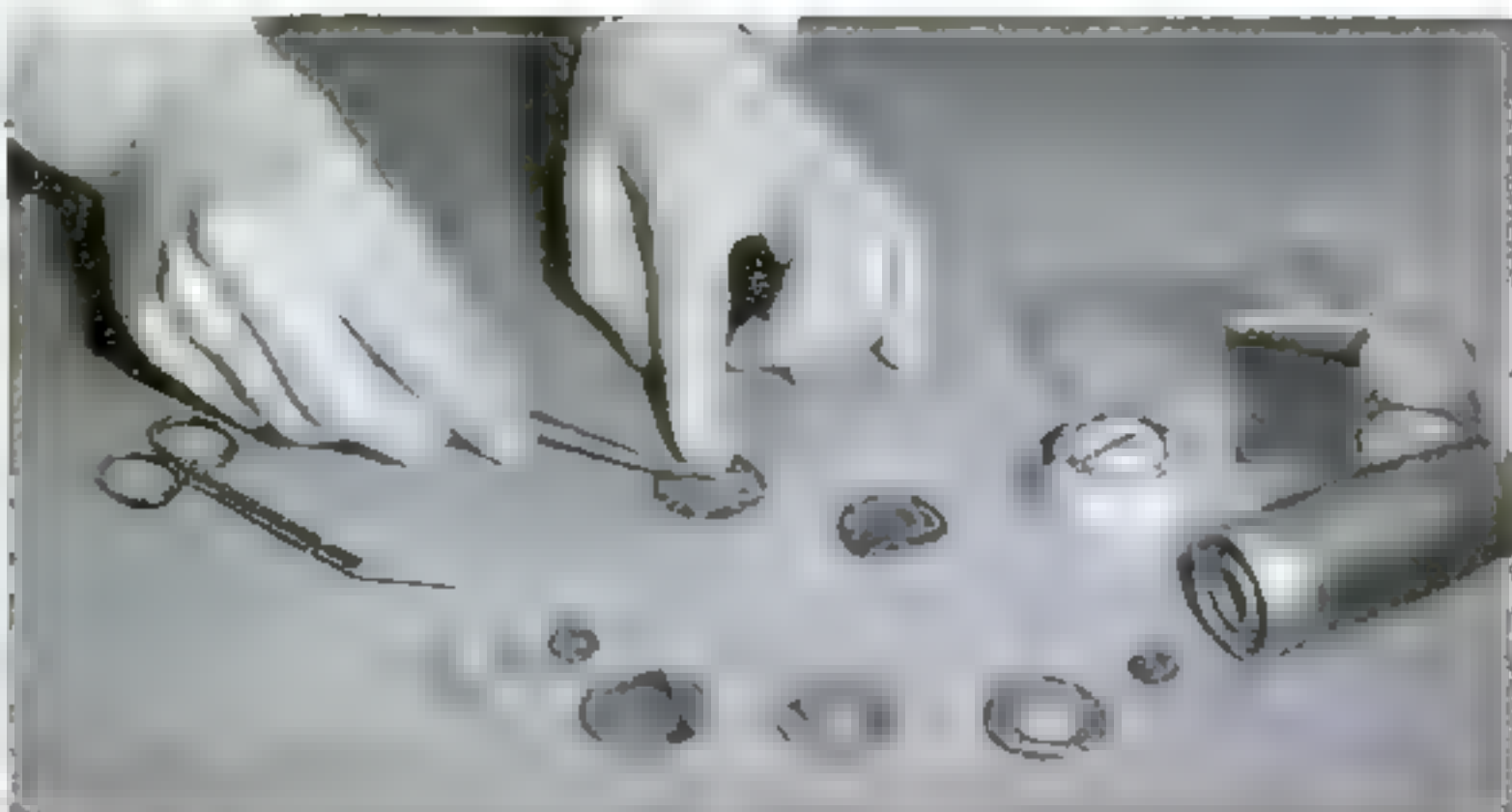
Filters can help overcome some of the shortcomings of cheap microscope lenses, and can improve the performance of even the best lenses of research microscopes. If the visible spectrum consisted of but one color of light, that is, one narrow band of wave lengths, the lens maker's job would be relatively simple. But it happens that the visible spectrum contains a number of distinct colors, ranging from violet to red. In passing through a given lens, each color is bent or refracted an amount different from the other colors. The result is that all the colors are not brought to a focus at the same distance from the lens—violet and blue being refracted the most and therefore forming an image closer to the lens than red, which is refracted the least.

In the cheapest microscope lenses, the makers usually try to bring the wave lengths we see most easily (yellow-green) to sharpest focus, and let it go at that. In other words, they correct the chromatic and spherical aberrations for but one color, if at all. (Chromatic aberration refers to the inability of a lens to bring all colors to a focus at the same distance; spherical aberration, to the inability to focus rays passing through the edge of a lens on the same plane as those passing through the center.) Professional-type

A spherical flask filled with colored water acts as a filter and also as a condensing lens when used as at the left. The drawing below shows the yoke that holds the flask in place



At the right, differential-color disks are being prepared by taping centers of one color over rings of another color. Rings are cut from gelatin with the punch illustrated

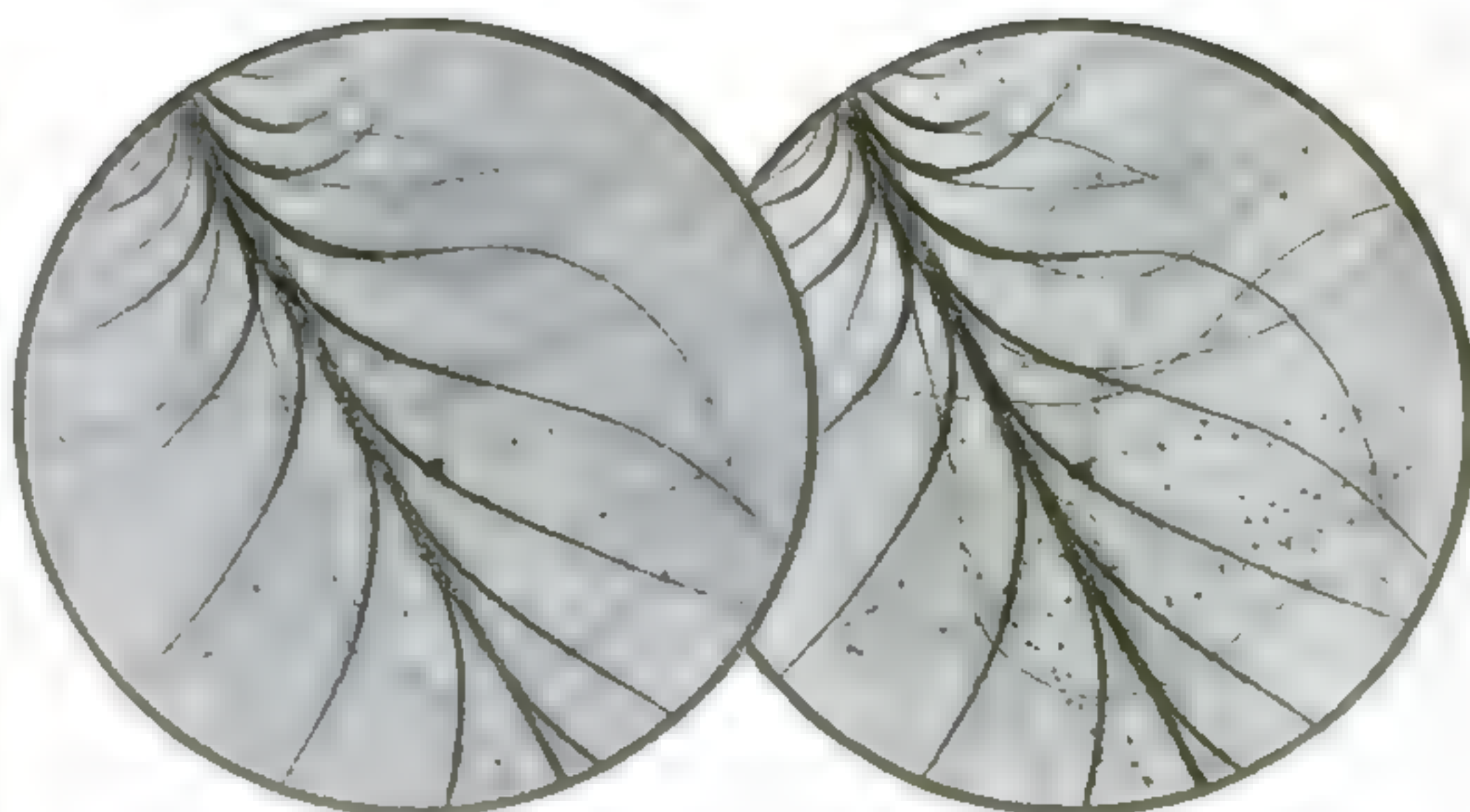


Help Your Microscope

microscopes are fitted with lenses having higher degrees of correction, which is one reason why they cost so much. For ordinary work, achromatic objectives having the chromatic aberration corrected for two colors, and spherical for one color, are employed. For more precise work, especially photomicrography with white light, apochromatic lenses are used. In these, the chromatic aberration is corrected for three colors and the spherical for two.

Obviously, if a microscope lens cannot bring all colors to a focus at one point, the image will not be of maximum sharpness. And, just as obviously, if you can eliminate some of the colors and examine the object by one relatively narrow band of wave lengths, the image will be sharper, because that narrow band or color can be focused with reasonable sharpness at one point. And that is where filters enter the picture.

A filter appears colored to the eye because it transmits some wave lengths and absorbs others. If you select a filter that transmits the color that the microscope lenses focus best because spherical aberration has been corrected for that wave band, and absorbs the colors that come to a focus either nearer the lens or farther away than the transmitted color, the image will look sharper. The best way to determine just what color filter to use is to try different ones and observe which makes the image the most distinct. Usually a green filter, or



Bird feather viewed through different filters. Note the improved contrast at the right

a green and yellow one together, will work best. For instance, achromatic objectives used in conjunction with a Huyghen's eyepiece (which is the type eyepiece normally employed) produce maximum sharpness with Wratten "B" and "G" filters together.

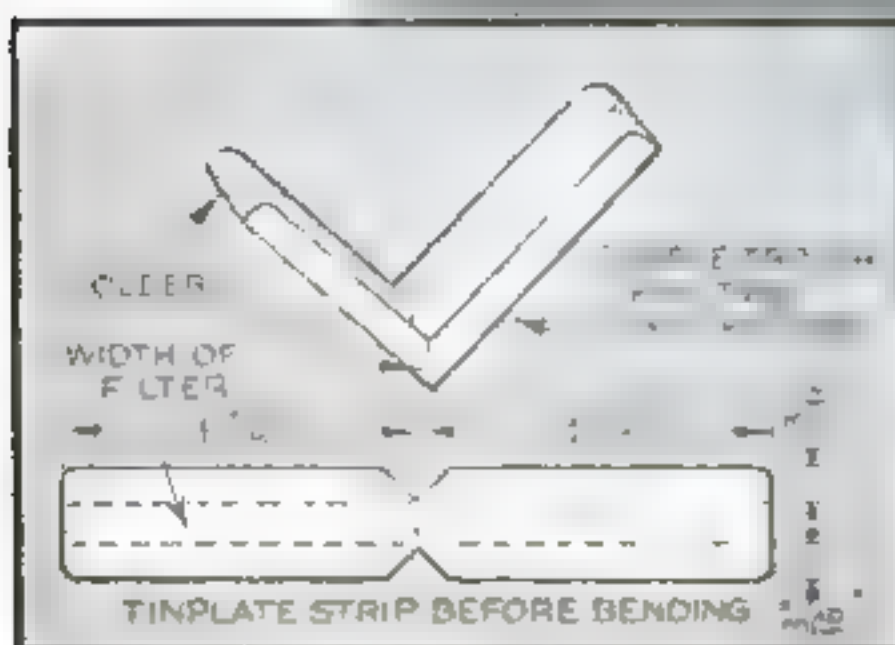
Because a filter absorbs some of the light, it reduces the intensity of the light passing through it. Therefore, in order to obtain sufficient illumination through the eyepiece, you probably will have to increase the intensity of the light source used for observation. If you use electric light, a lamp of greater wattage will solve the problem.

The second great use of

filters in microscopy, the control of color contrast, depends also on the light-absorbing and transmitting properties of translucent colored material, and on the observing of objects that contain color. If you like rules, here is one that you can remember in connection with contrast control: Contrast is in- (Continued on page 96)



Convenient color filters are made by sandwiching stained sheet gelatin between pieces of glass and taping the edges as shown



Here's a handy homemade holder for filters of this type. The drawing at the left shows how the V troughs are bent from metal. It holds two filters



Handy Eye Shade Prevents Confusion of Images

IF YOU are troubled by confusion of images when you look through your microscope with both eyes open, this eye shade will help you. It is made from an old eyeglass frame with a dark frosted glass fitted in one lens rim. The other rim is reduced in size so that it will fit snugly around the ocular holder.

You can hold your finger in this tiny flame of burning phosphorus, without feeling any sensation of warmth!

WEIRD lights appearing in the dark, substances that mysteriously burst into flame, and a magical "cold fire" that will not even scorch your finger—these are some of the thrills that await you when you experiment in your home laboratory with the strange element, phosphorus, and its compounds.

Fittingly enough, the chemical element endowed with properties so suggestive of black magic was discovered by a medieval alchemist in search of the much-hunted philosophers' stone. Early chemists, stoking their distillation furnaces to white heat, manufactured phosphorus from animal bones mixed with sand and charcoal. You can make it in much the same way, but in a fraction of the time and without recourse to terrific heat; for you can employ aluminum, unknown to earlier workers, in the reaction that separates phosphorus from its compounds.

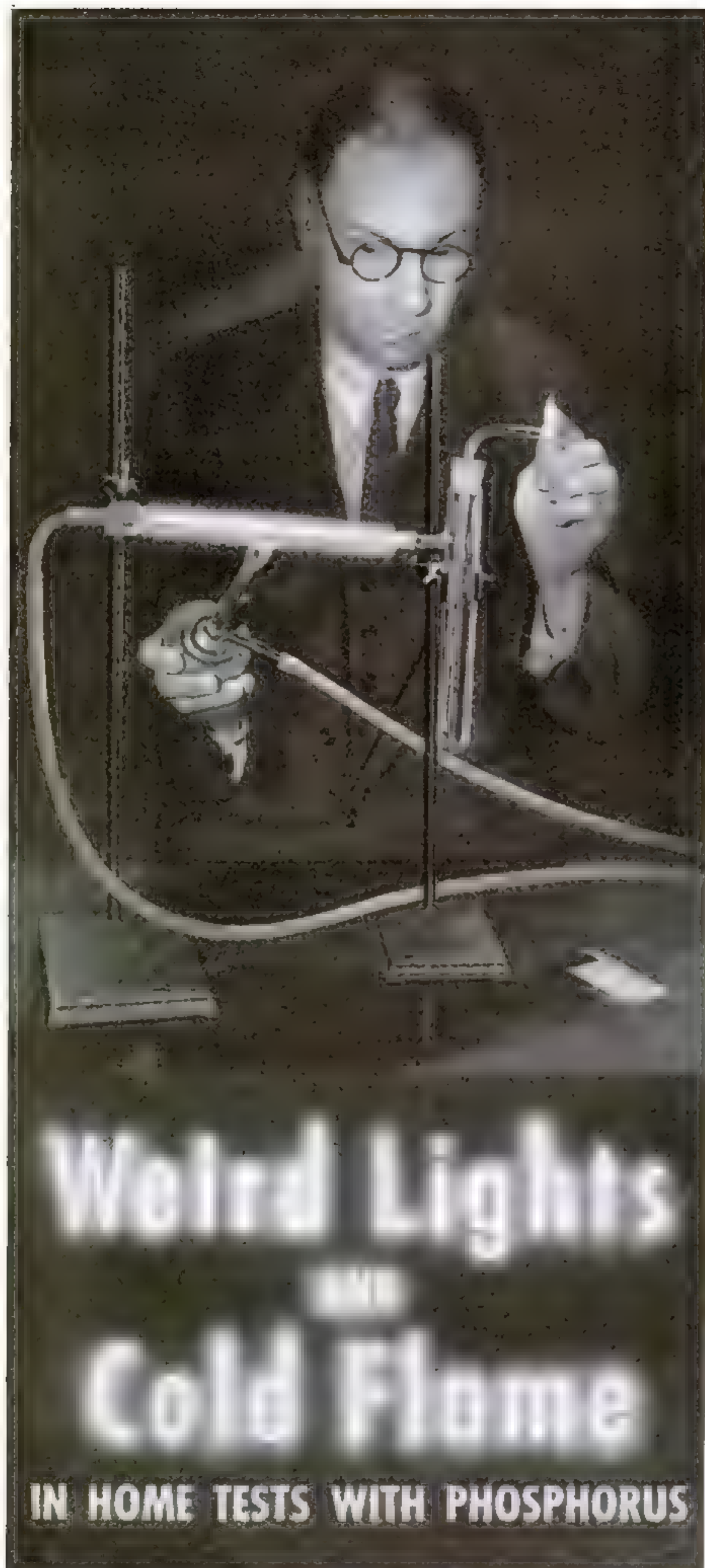
What you will obtain, you would find if you could examine it closely, is a whitish-yellow solid. Distinguished from a much tamer red-colored variety, this kind of phosphorus will take fire spontaneously in the air, and has to be kept submerged in water. You will do well to regard it as a treacherous chemical that should have no place on the shelves of an amateur laboratory. Fortunately you can safely enjoy the fun of making it in the following experiment, because it is converted into a harmless by-product as fast as it is formed.

You could obtain phosphorus from bones, just as the early chemists did and as the operators of electric furnaces in modern chemical factories still do, because bones consist very largely of a compound of phosphorus, called calcium phosphate. In fact, your own skeleton contains more than three pounds of phosphorus! Another commercial raw material for making phosphorus, a mineral ore with the odd name of apatite, contains the element in combination with calcium and fluorine. Probably the most convenient source of phosphorus for your experiments, however, will be a compound known as sodium ammonium hydrogen phosphate, or "microcosmic salt" for short. Any dealer in chemicals can supply it.

Heat about a teaspoonful of microcosmic salt upon a tin-can lid. The crystals will literally stew in their own juice, the water that they contain, and your nose will detect the odor of escaping ammonia as they decompose. Soon the melt will become pasty and you will see it blowing itself into brittle bubbles. The final residue will be a glasslike solid—sodium phosphate.

Grind up this sodium phosphate in a mortar, together with its own volume of aluminum dust and twice its volume of sand. A powdered form of aluminum sold at hardware and paint stores, for making metallic paint, is suitable for use in this formula.

Place your preparation in a glass tube between six and ten inches in length, and anywhere from three eighths to three quarters of an inch in diameter. Little, loosely fitting plugs of asbestos, inserted at each end of the tube, will keep the powdered mixture from spilling out. Attach one end of the tube to a supply of illuminating gas. Connect the other end of the tube to a small,



By RAYMOND B. WAILES

empty flask, through a two-hole stopper fitted with an additional tube for an outlet, or to a side-arm test tube, as shown in one of the photographs. This vessel serves as an air-cooled condenser.

Let illuminating gas flow very slowly into the tube containing the chemicals, and through the condensing vessel. Since the gas and air together form an explosive mixture in the apparatus, leave the gas flowing and wait for half a minute to make sure that all the air is driven out. Then light the gas that is issuing from the outlet tube. Do not risk an explosion by lighting it sooner. The gas supply should be adjusted until the flame is about half an inch high. If the chemical mixture in the glass tube is packed too tightly, the gas will have difficulty in getting through; with the tube in its horizontal position, there should be a clear space above the chemicals for the passage of the gas.

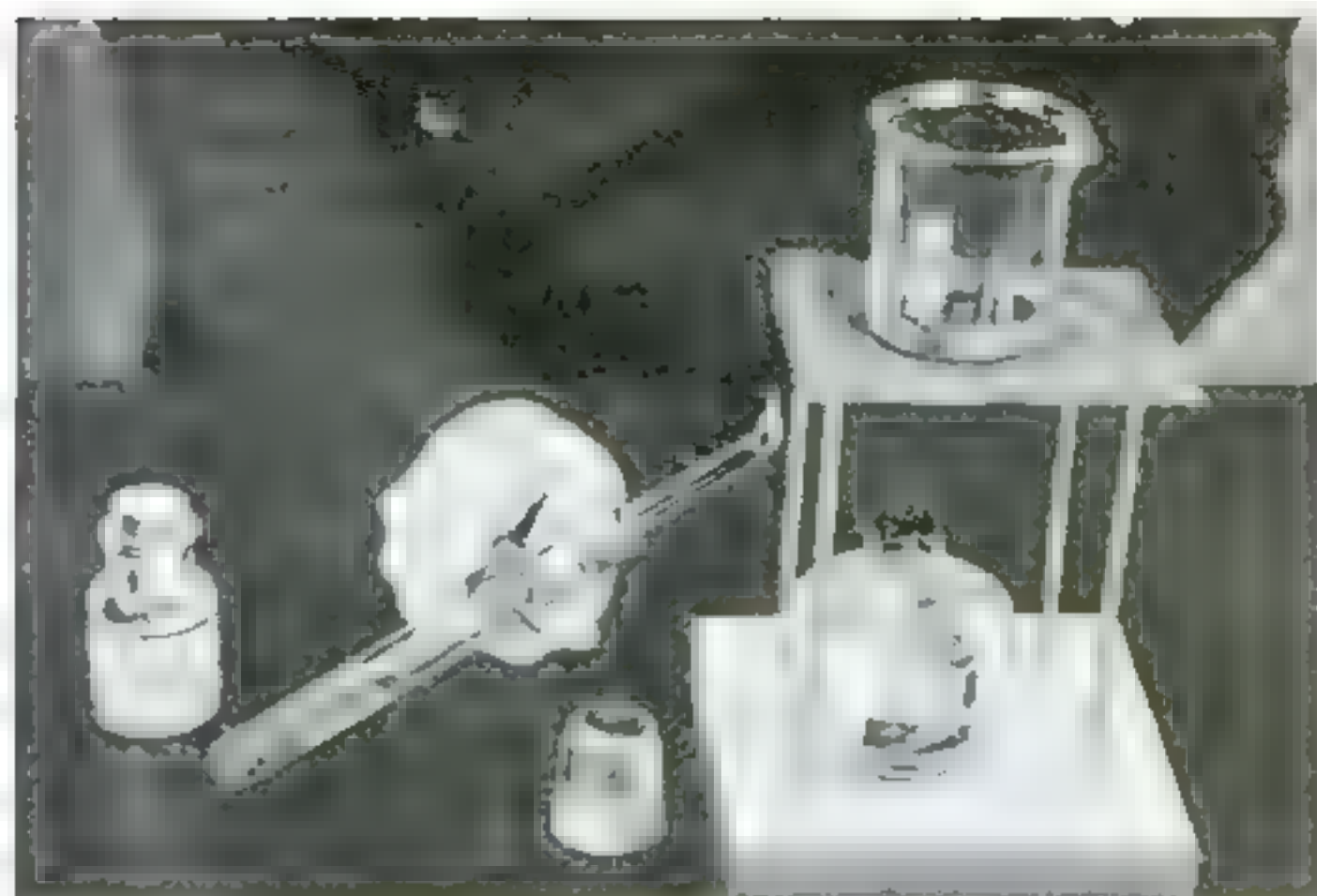
NOW heat the center of the glass tube with a Bunsen burner. As soon as the chemicals get hot enough, the aluminum and sand will react with the sodium phosphate. Free or uncombined phosphorus, in an extremely finely divided state, will be liberated. The stream of illuminating gas will carry the phosphorus along with it. Some of the phosphorus will be deposited in the condenser, but most of it will be borne along to the outlet of the apparatus and will burn with the gas in the open air. You can tell when this is happening by the green tint that the phosphorus will impart to the flame.

At this point, darken the room and

blow out the flame. The tiny particles of phosphorus will continue to burn, taking fire spontaneously as they strike the air and producing a mysterious flame without heat! It glows with a yellowish-green hue, like the figures on a radium-dial clock. Thrust a scrap of tissue paper or cigarette paper into this "cold fire," and it will not be scorched in the least. What would happen if you held your finger directly in the queer flame? Try it. There is not the slightest risk of suffering a burn!

Do not jump to the mistaken conclusion that burning phosphorus always produces a harmless flame. A fairly sizable piece of phosphorus—in fact, one no larger than a small pea—takes fire fiercely and can inflict serious burns. It is only under the particular circumstances of the experiment just described that the magical "cold fire" is produced. As a by-product of this startling experiment, you will notice the onionlike odor of burning phosphorus. The white smoke that you may observe is phosphorus pentoxide, formed by the union of the phosphorus with the oxygen of the air.

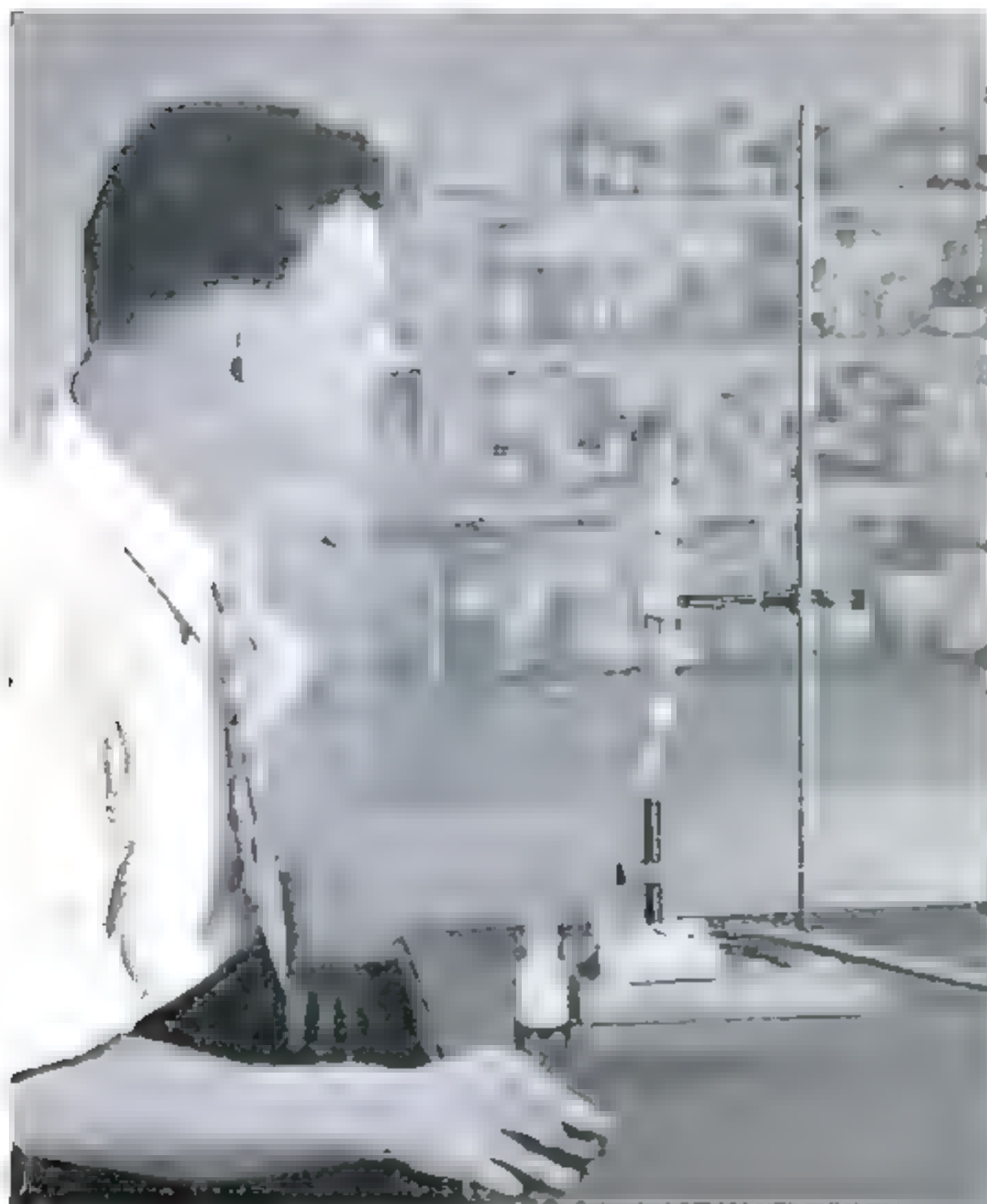
Leave the room darkened when, at the conclusion of this experiment, you take the apparatus apart. As soon as air enters it, the condensing vessel will glow as if afire. The mysterious light



A phosphorus compound is used to prepare copper hydride, which decomposes into hydrogen gas and finely divided metallic copper

comes from a thin film of phosphorus, on the interior of the vessel, which combines with the oxygen of the air and phosphoresces. Place a stopper in the condenser, shutting off the air supply, and the firefly glow will be extinguished.

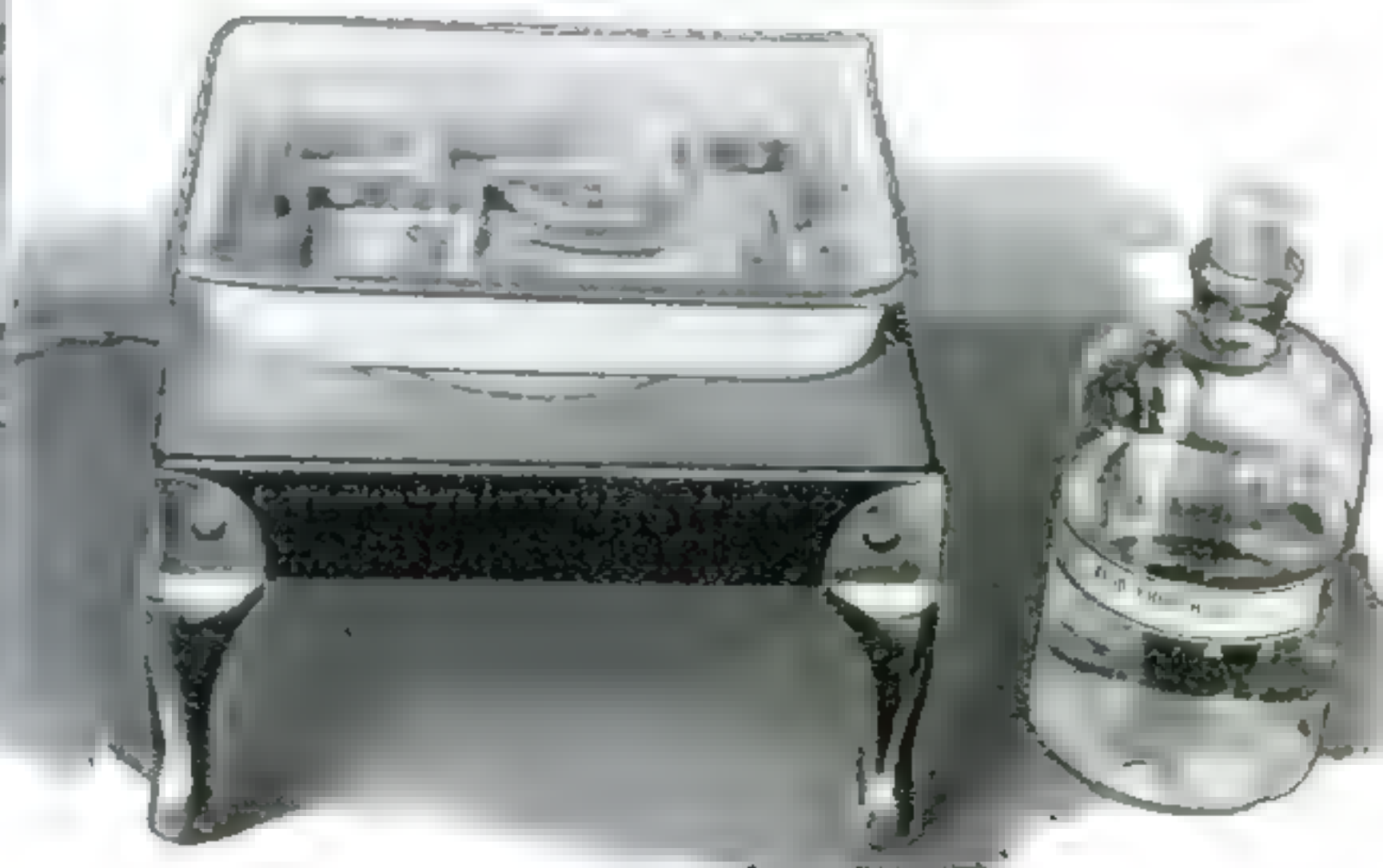
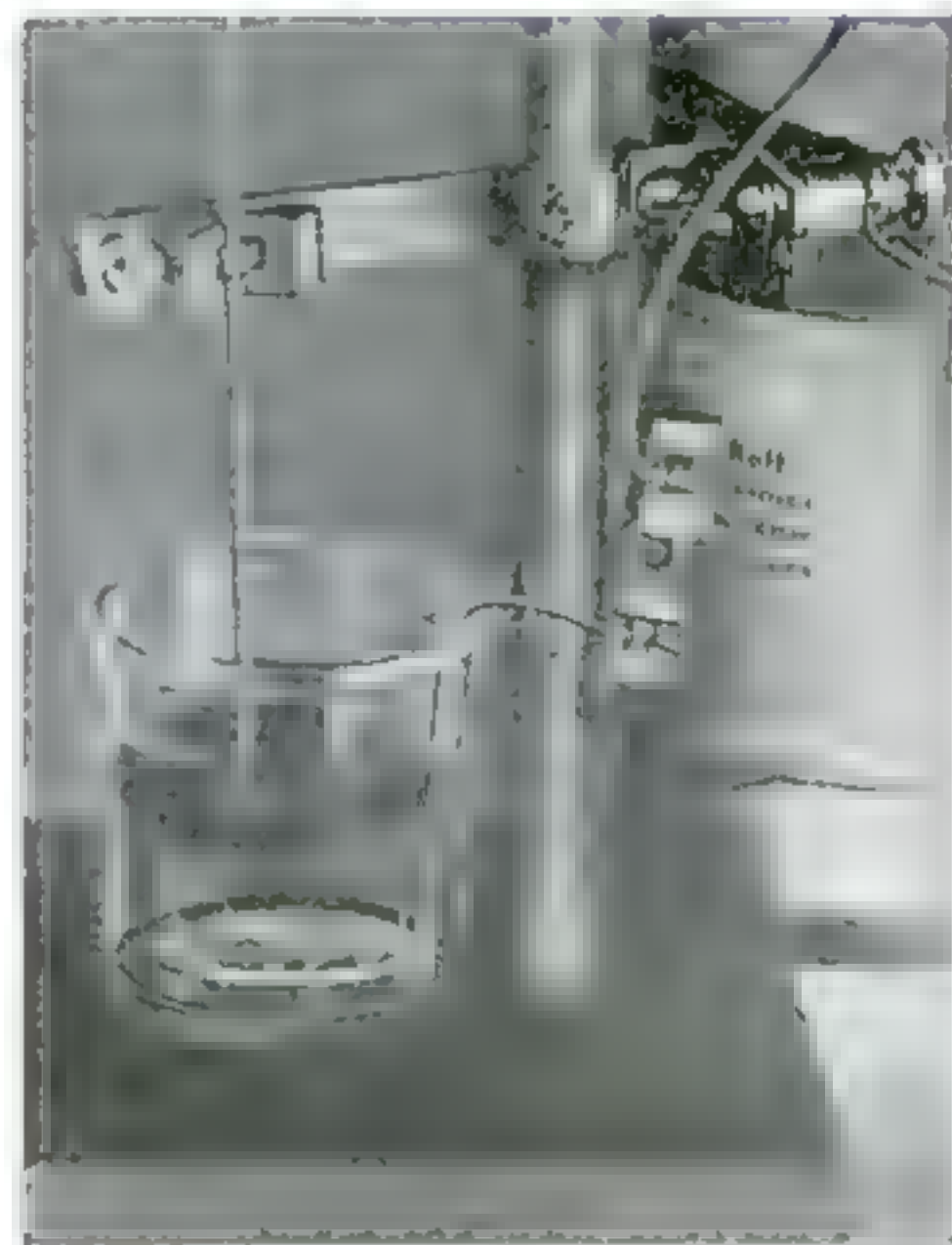
You may have wondered whether the illuminating gas plays any chemical part in the reaction that produces the phosphorus. It does not; it acts simply as a carrier for the phosphorus particles. A stream of air would do as well, were it not for the fact that the oxygen of the air (*Continued on page 102*)



Phosphine gas, produced by heating sodium hypophosphite in the test tube, spontaneously takes fire when it comes into contact with the air

Copper coins and medals can be cleaned by using phosphoric acid in the simple electrolytic apparatus pictured at the right. It is operated by only two dry cells

Below, iron objects are being boiled in a phosphoric acid solution to give them a "phosphate coating" before being painted





Dining-Table Radio

HAS HOLDERS FOR FLOWERS

YOU'LL go a long way before you find a radio receiver that will give you more pleasure than the dining-room-table model described on these pages. Particularly useful in homes or apartments of moderate size, this small set not only allows you to tune in your favorite programs without leaving the dinner table, but it combines the qualities of a decorative centerpiece flower holder with those of a sensitive, powerful receiver.

It is simple to make and can be plugged into any convenient electric outlet.

Using a tuned, radio-frequency circuit, the five-tube set has an extremely compact chassis, measuring 2 by 4½ by 7 in. The compactness is achieved mainly through the use of metal tubes and new-type midget antenna and radio-frequency coils. Other parts, such as the fixed resistors, volume-control unit, mica condensers, dual-electric condenser, and the 15-h. filter choke, also are of the midget type.

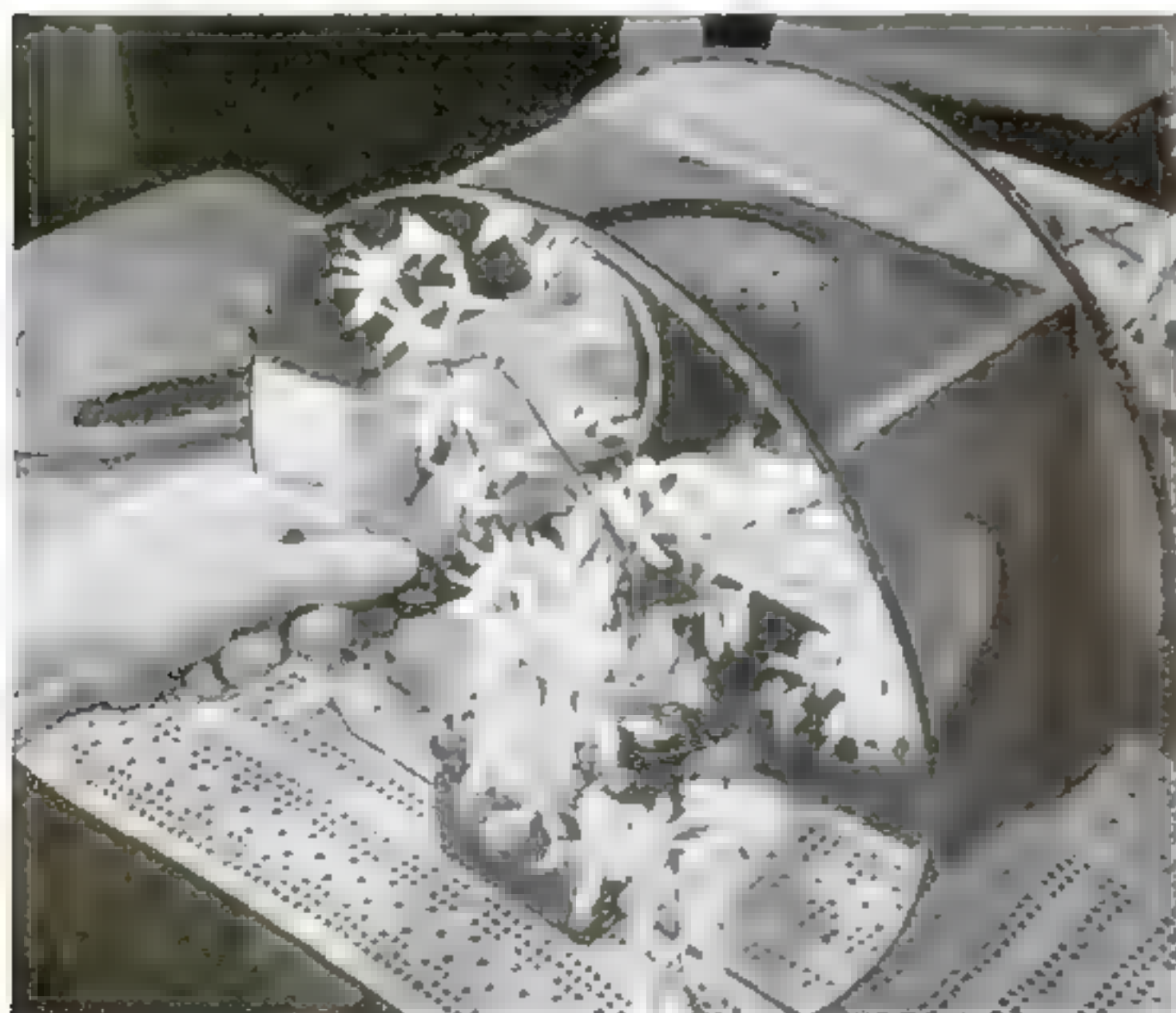
In making the cabinet, follow the drawings and photographs carefully. As the illustrations indicate, the wood sides are faced with decorative curved mirrors mounted over plywood panels ⅛ in. thick. To avoid any errors, complete the set before obtaining the mirrors. Make separate paper

templates from the wood panels before you cut the glass and be sure that the holes for the control shafts that extend through one of the mirrors are accurately placed. If you wish, you can have the mirrors cut to shape by your neighborhood glazier.

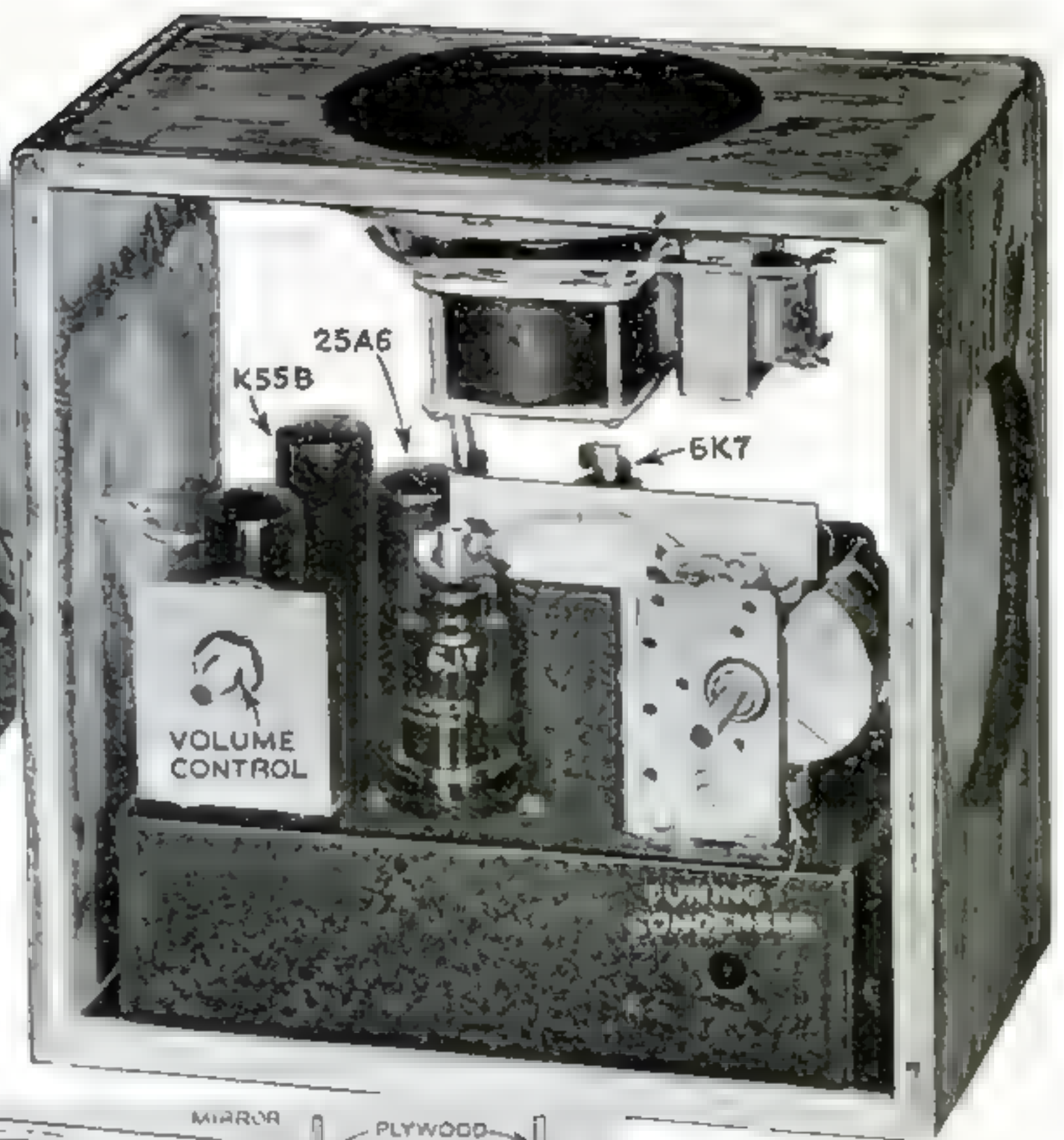
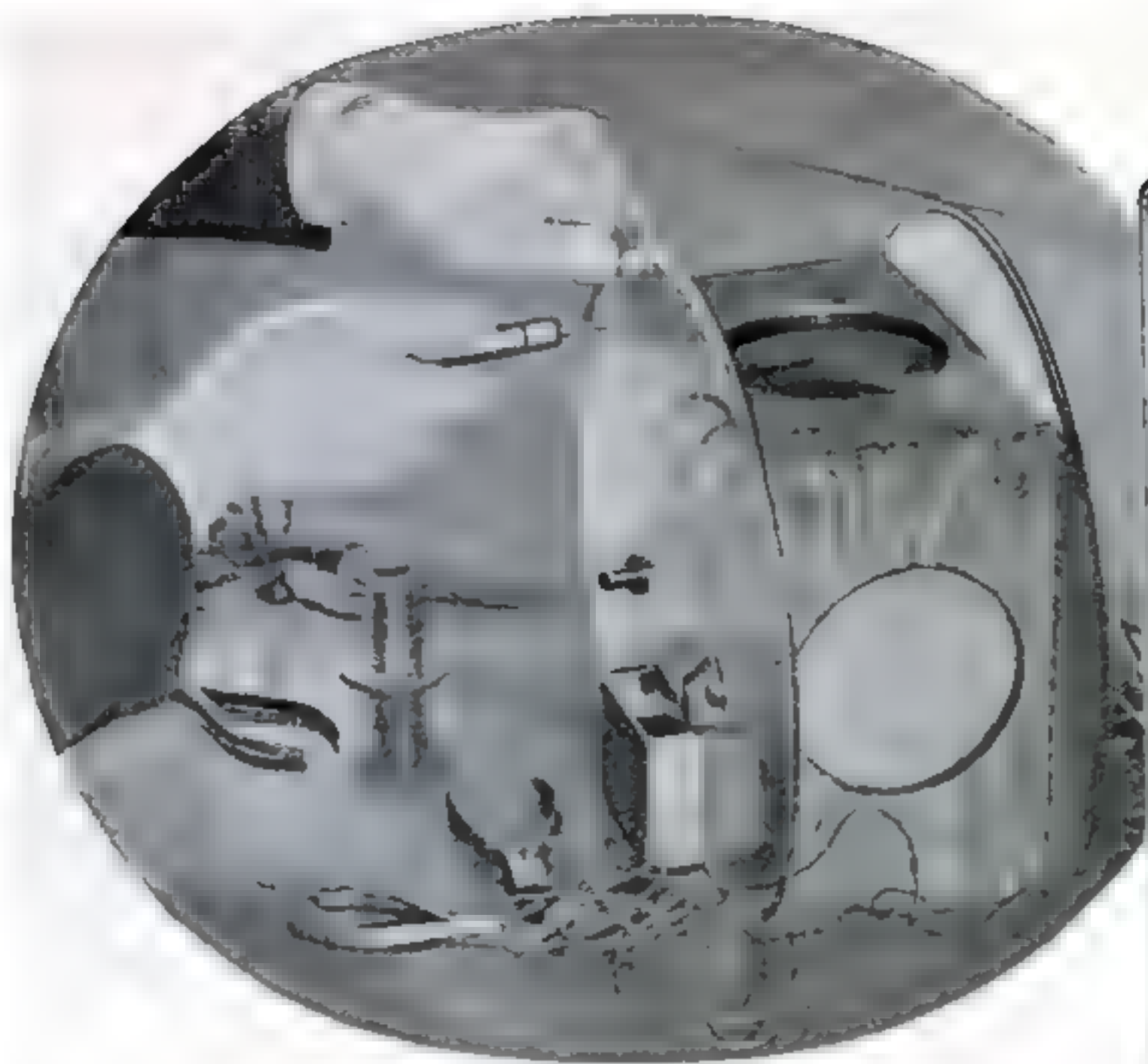
Cut three circles 4½ in. in diameter in the two sides and the top of the cabinet. The side holes are for ventilating purposes, while the top one serves as the opening for the 5-in. permanent-magnet dynamic speaker. Cover all three of the holes with speaker-grille cloth or some similar type of decorative material.

The flower holders can be made from the same width plywood used in making the sides, and are attached to the panels with nails. Their inside dimensions should be 1 by 2½ by 3 in. With a pair of tin shears, cut the tops from two ordinary tobacco cans, leaving the bottoms just 3 in. high. Put these inside the holders and you will then have water-tight containers in which to place cut flowers. The glass sides of the cabinet are cut to fit around the flower holders.

In building the circuit, it should be borne in mind that careful workmanship will insure long life for your dining-room-table receiver. A small strip of aluminum 1/16 by 3½ by ¾ in. should be mounted between the two sections of the two-gang tuning condenser. This will shield the two grid leads to the radio-frequency and de-



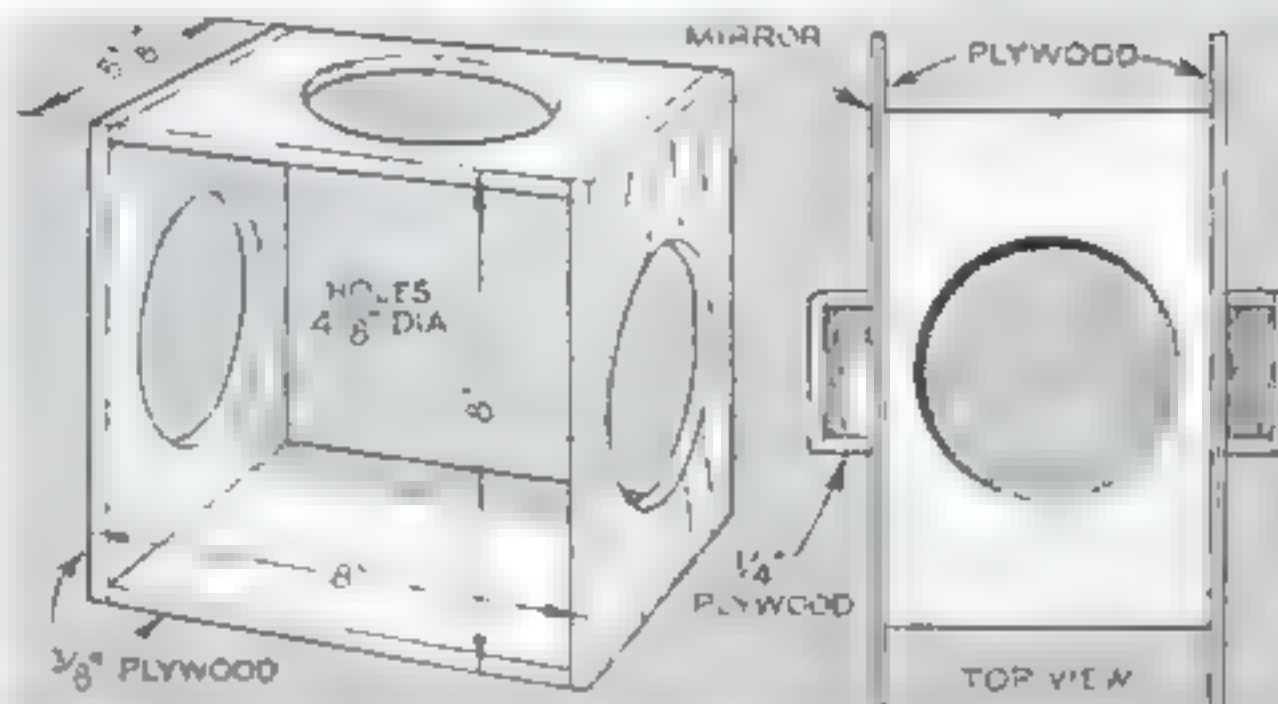
Tin cups inside the holders contain water for flowers arranged against the mirrors



By FRANK TOBIN

rector tubes, and prevent oscillation caused by feed-back. The position of the flat type of volume-control unit, in relation to the rectifier tube, is clearly shown in the photographs.

To step down the voltage for the tube filaments, it is best not to use a power cord having a built-in resistance. This type is too short and bulky for the special requirements of a set that is placed in the middle of your dining-room table. Instead, obtain a small resistor element that is made similar in size and shape to the 25A6 metal tubes. This will allow you to use a power cord of any length necessary to run it from the center of the table, under the carpet, and to a convenient wall plug. Here, too, it is well to caution against use of conventional twisted cord, as it will be too bulky under most carpets, and constant walking over it will eventually mark your floor covering. Use the all-rubber, parallel type of flat lamp cord which is available in green, ivory, brown, or black. If your rug is loosely woven, separate several threads near the center of your table and run the cord through. It is a good idea to make



Cloth-covered holes in the cabinet sides and top, upper left, serve as speaker vents

Above, how the metal chassis and permanent-magnet dynamic speaker are mounted in the wooden cabinet

The drawing at left will help you to construct the cabinet

a knot in the rubber power cord on the inside of the chassis, in order to avoid strain on its soldered connections.

For best reception, a good, outdoor antenna should be used. However, good results may be had with an indoor antenna which may be left dangling beneath the table, spread out under the carpet, or even twisted around the power cord.

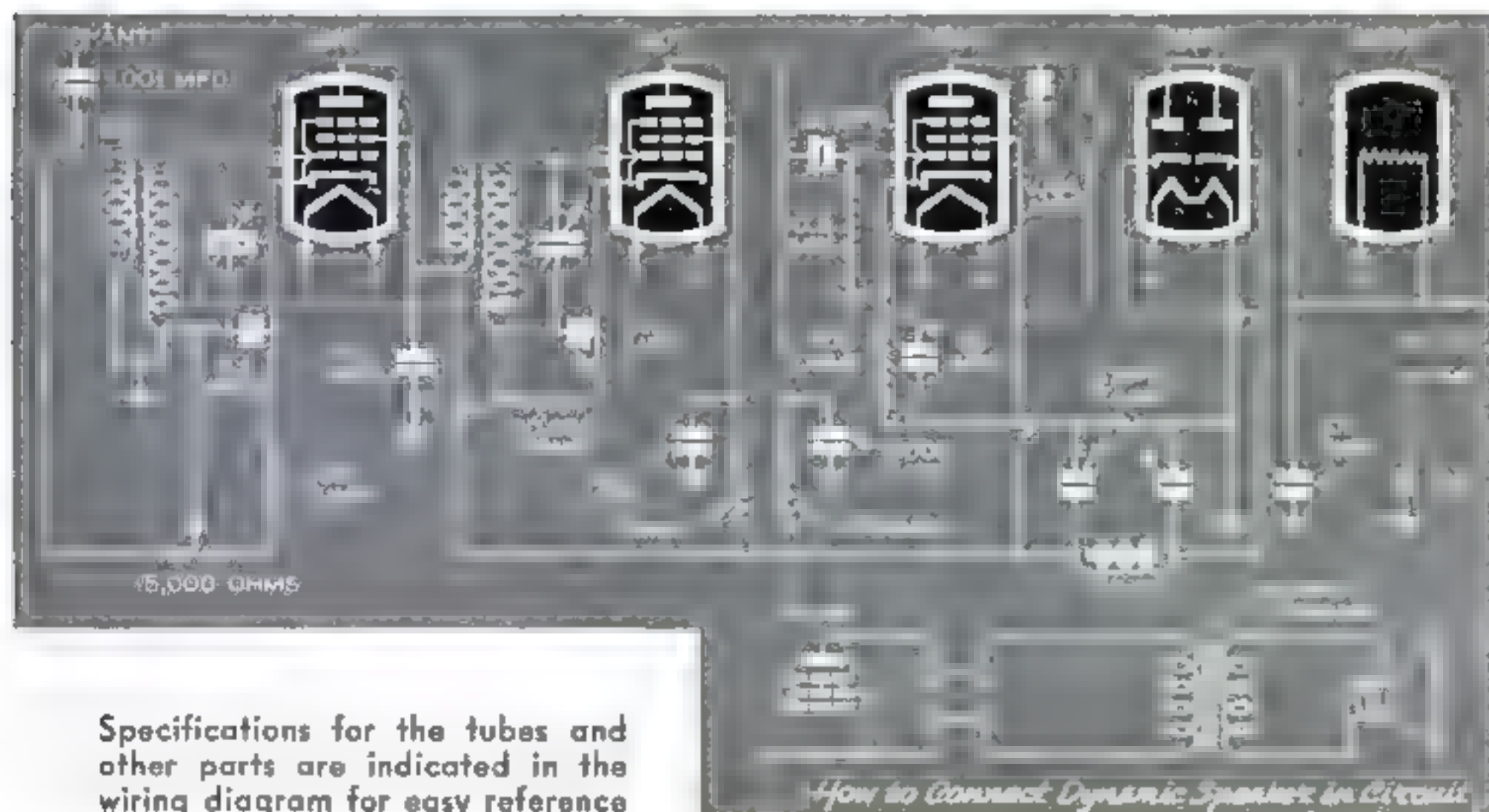
Two details should not be overlooked in building the dining-table radio. First, do not fasten the radio's glass panels

so securely that they can not be removed for repairs or replacement of parts. Second, mounting screws forced against the brittle mirrors may crack the glass. To avoid this, make or purchase tiny rubber washers of a diameter small enough to fit the screw shanks and protect the glass.

WHAT YOU NEED

High-impedance antenna coil.
High-impedance radio-frequency coil.
Two-gang tuning condenser.
Tubular condenser, .01 mfd.
Tubular condenser, .006 mfd.
Tubular condensers, four, .1 mfd.
Tubular condenser, .05 mfd.
Mica fixed condenser, .0005 mfd.
Mica fixed condenser, .001 mfd.
Electrolytic condenser, 50 v., 10 mfd.
Dual electrolytic condenser, 8 mfd.
Resistor, 300 ohm, 1/2 watt.
Resistor, 50,000 ohm, 1/2 watt.
Resistor, 250,000 ohm, 1/2 watt.
Resistor, 500,000 ohm, 1/2 watt.
Resistor, 2 meg, 1/2 watt.
Resistor, 400 ohm, 1 watt.
Filter choke, 15 h., 250 ohm.

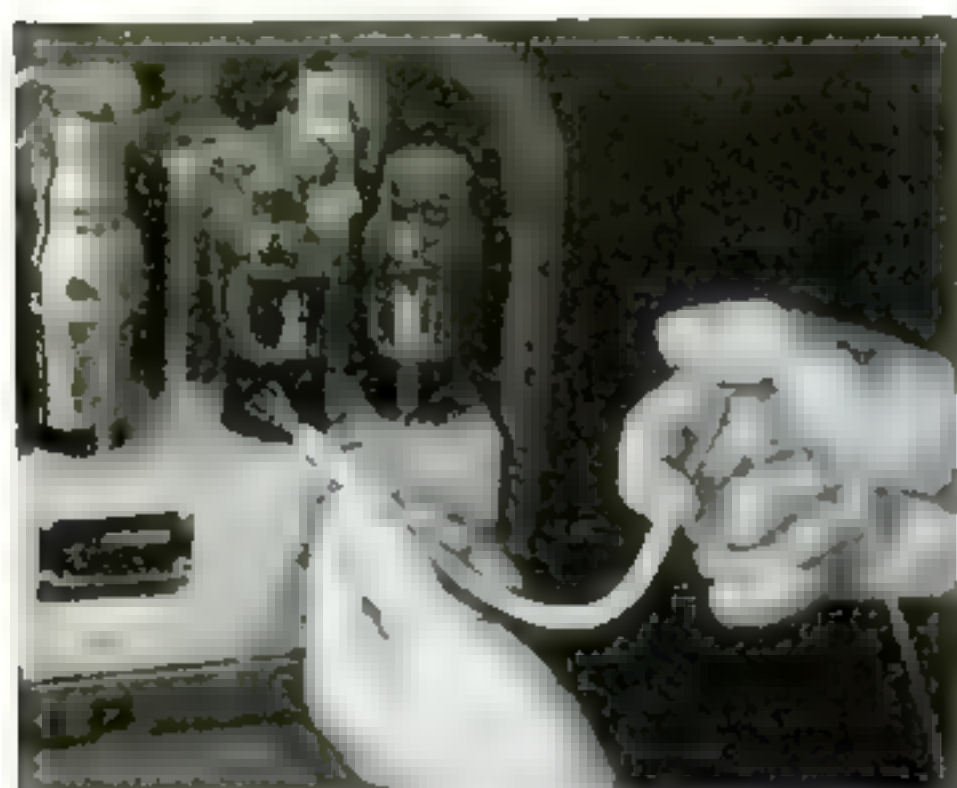
Miscellaneous.—Octal tubes and tube bases (see diagram), chassis (see text), speaker (see text), tie lugs, metal grid caps, etc.



Handy Aids for Radio Workers

Flexible Test Prod Reaches Hidden Parts

DESIGNED like the flexible-cable shutter release on a camera, an insulated test prod for use in testing compact radio hook-ups has a set of contact jaws on one end, opened and closed by a push button on the other end. The device also can be used for starting small screws.



Pushing top of test prod opens the jaws



In this new-type illuminated meter, the socket is easily removed, as above, to replace bulb



Bulbs Are Easily Replaced in New Meters

DIAL LAMPS are easily replaced when necessary in a new-type radio meter. The tiny bulb sockets simply plug into holes provided in the backs of the meter

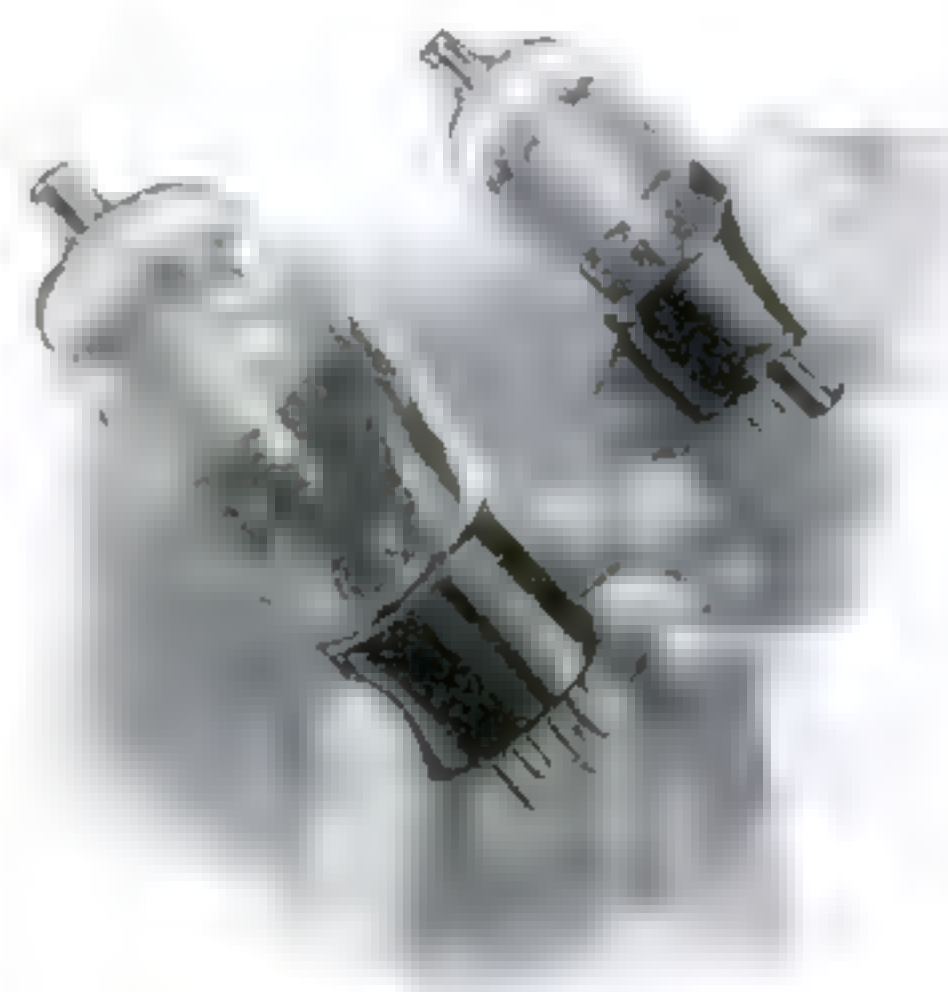
cases, and can be quickly removed, or adjusted as shown above. The sockets are provided with a convenient pair of wires for making connections.

Resistor Cabinet Has Built-in Color-Code Dial



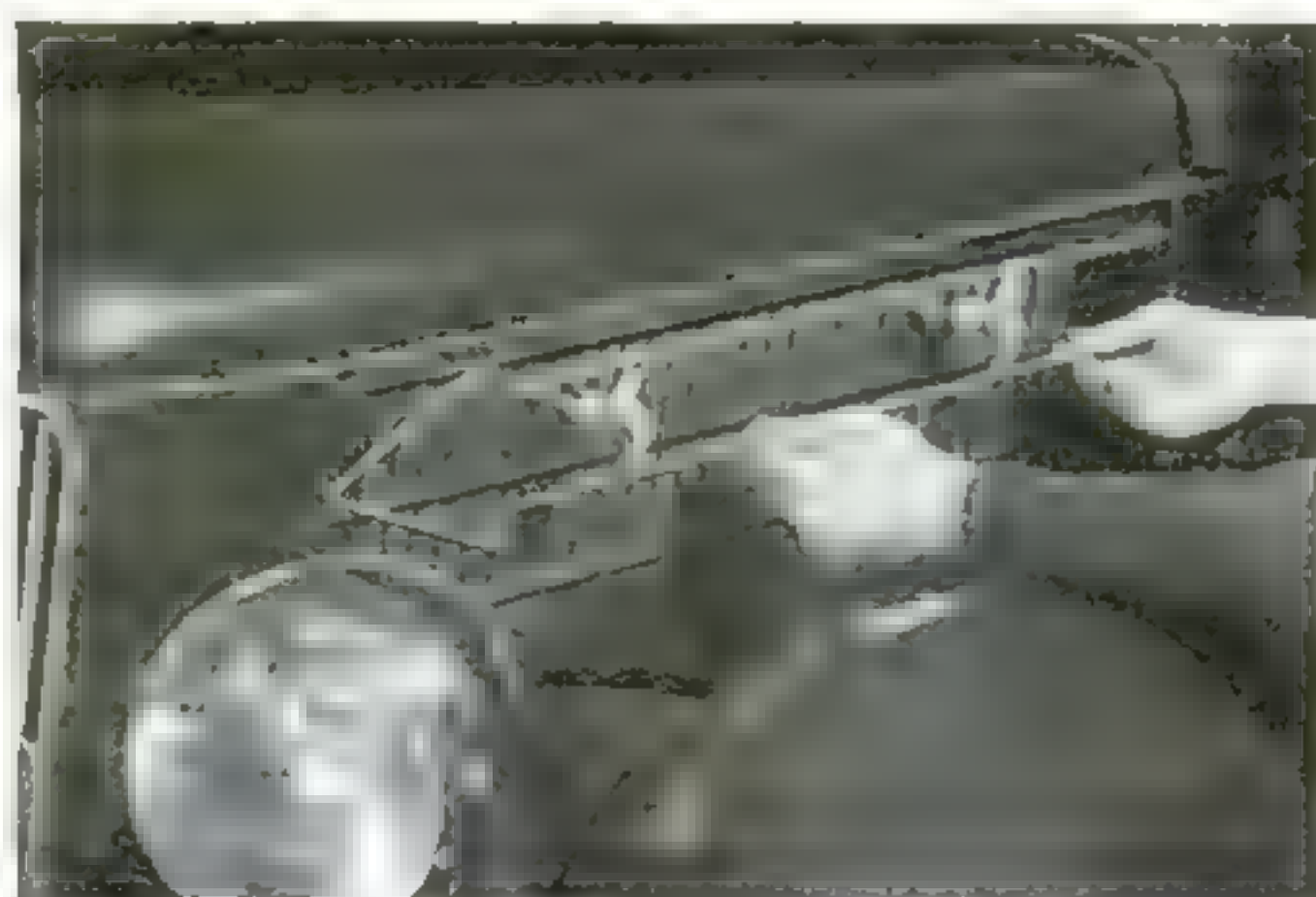
The color dial on the cabinet door shows the resistance values

HOUSING a wide assortment of resistances, as well as a color chart for determining resistor values, a new wall cabinet makes a handy accessory for your workshop. Any size of resistor can be selected by simply setting three concentric, colored disks inside the cabinet door to the desired resistance value. The resulting arrangement enables the amateur to select the corresponding color-coded units from the cabinet.



Car Antennas Fasten to Hood

EASILY mounted on both sides of the hood of your car, a decorative, two-in-one radio antenna provides a maximum of pick-up surface in a minimum of space. Ground noises, static, and motor noises also are said to be reduced because of the position of the units, which are not effected by weather.



One of these decorative antennas goes on each side of a hood

New Midget Radio Tube Fits in Small Sets

MADE especially for compact circuits in small cabinets, a vest-pocket glass radio tube just introduced is designed to have electrical characteristics identical to the larger glass types. The relative size of the diminutive new tube, compared with a standard-size tube, is shown in the illustration above. A four-tube set employing the tubes can be built into a cabinet less than six inches long, four and a half inches high, and three and three quarter inches deep. The tiny tubes have the new octal, eight-prong type of base, making them interchangeable with the all-metal type of tubes, and are designed to dissipate their heat quickly.

ONE-PIECE Light-Duty Tent

FOR BEACH AND PICNIC USE

By
Bertram Brownold

A LIGHT-DUTY tent or shelter, especially useful at the beach, can be made as shown from a single piece of unbleached muslin 90 in. wide and 5½ yd. long. It costs less than a large beach umbrella, yet will serve as a shade canopy, an open tent, a small or large lean-to, a windbreak, or even as a dressing tent if extra triangular end pieces are fastened on with safety pins.

The selection of the material is most important. It should be unbleached and undyed (for durability) and should weigh about 12 oz. to the lineal yard, or a little more than 4 lb. altogether. Don't be afraid to ask the clerk at the department store where it is purchased to weigh the whole piece and divide by the number of yards to see if the goods are the right weight. Yard-goods departments keep scales handy for that purpose.

Fold back 3 in. at each end of the cloth and cement it down with rubber cement. Instead of having grommets attached, which may be inconvenient, obtain eight galvanized iron rings 1¼ in. in outside diameter from a dealer in marine hardware, or make substitutes

by cutting the shanks from galvanized screw eyes or bending rings of heavy copper wire. The rings should be sewed with heavy linen thread to the doubled ends of the cloth, four at each end, spaced at intervals of 30 in.

The poles are 1½ in. in diameter and 8 ft. long. Each is in two parts, joined in the middle with brass pipe. The ground end is pointed and has a 6-in. spike through it at right angles, 4 in. from the end, to prevent it from sinking too deeply into soft soil or sand. The upper end has a ver-

Various ways to make use of the shelter. If a dressing tent is required, two triangular ends are made and held with large safety pins

All-Purpose Tent



The tent set up for beach use. Buried sandbags are used to anchor the guy ropes. Left, ready to pack

Small Lean-to



When a small lean-to is needed, a similar set-up is used, but the muslin is doubled

tical spike, for the guy ropes. In place of tent pegs, bags are used and filled with earth, sand, gravel, or rocks on the spot. One bag is roped to each of the rings, and one is roped to the top of each tent pole.

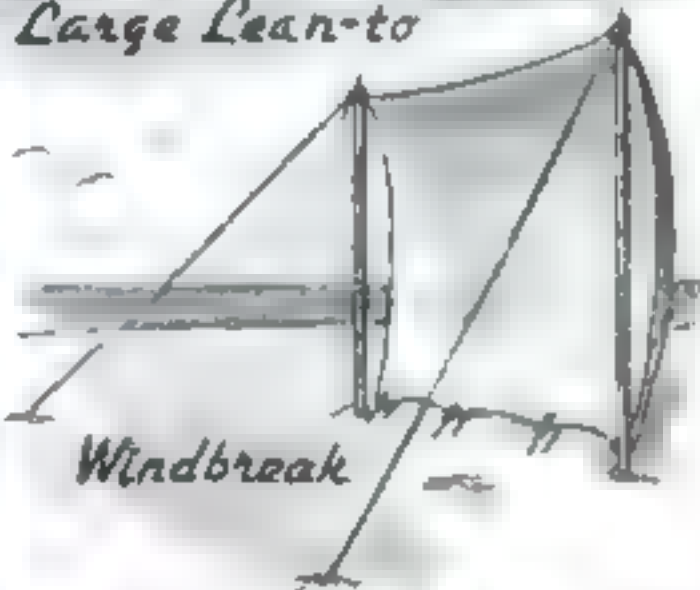
To set up the tent, stretch the fabric on the ground with all ropes taut. Run a 90-in. length of rope, which has a small loop at each end, under the tent from front to rear in the exact center. Insert the spike of a tent pole in each loop. Two men can then each raise one pole and thrust the sharp end into the ground or sand.

For certain uses only some of the bags are required, and greater anchorage can then be obtained by burying them after they are filled.

Silencing a Vise Handle

A RUBBER umbrella ring, slipped over each end of the handle of a machinist's vise, will deaden the noise caused when the handle is allowed to slide through its hole and the uppermost knob strikes sharply.—E. WONDRAKEK.

Large Lean-to

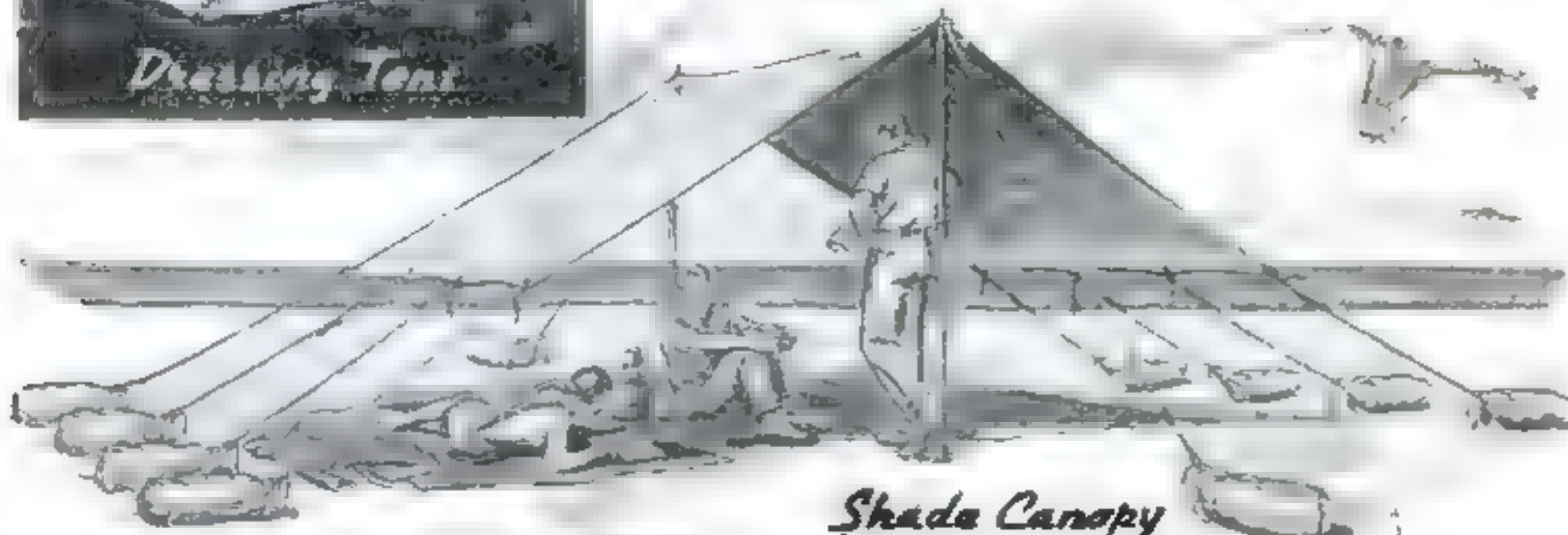


Windbreak



Dressing Tent

Shade Canopy

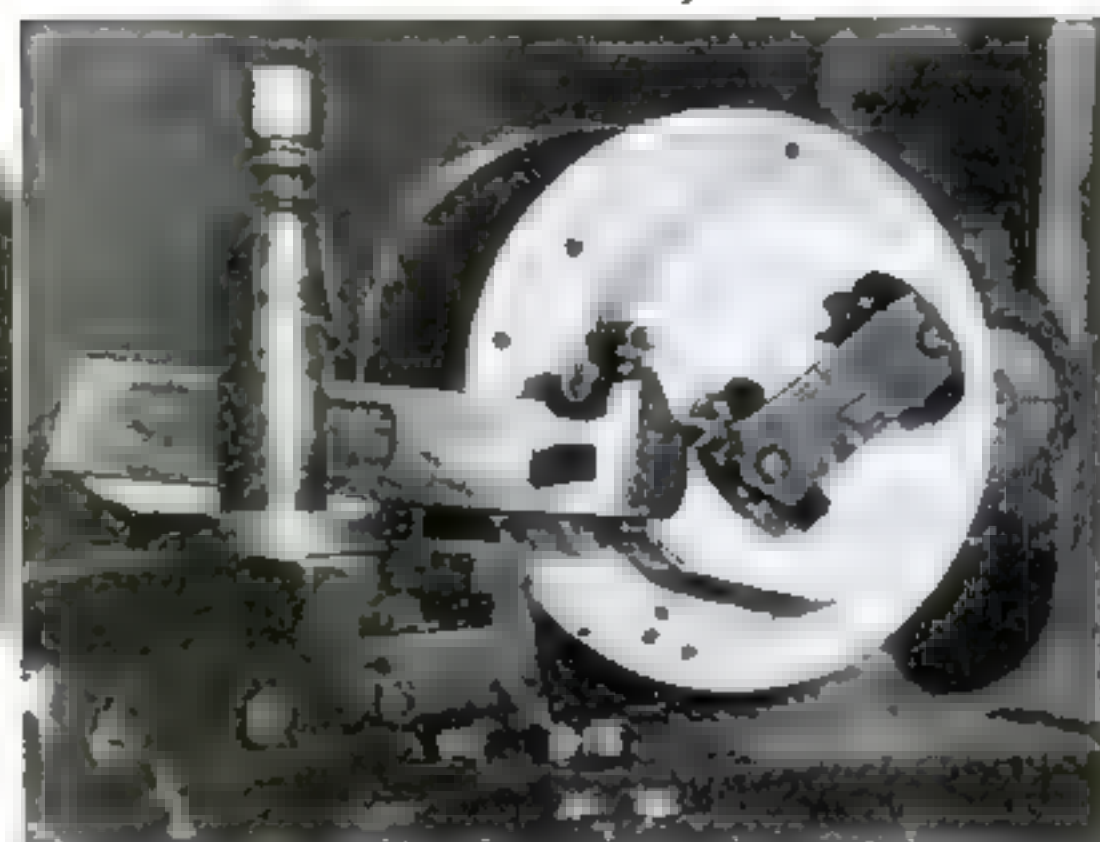


TUBULAR LAMPS GIVE UNIFORM ILLUMINATION FOR Photo Copying Stand

By
DONALD R. DOREMUS



Left, an assembled reflector. Above, the parts. The wood base is bored out and loaded with lead



Special sockets are supplied with the lamps, and these have to be turned to fit the reflectors as shown above

A PHOTOGRAPHIC copying stand that gives a uniform light over the entire surface of the work can be made as illustrated. The dimensions may be modified to suit the builder provided the reflectors are of a length to hold the long tubular lamps now commonly sold for use beside mirrors and in other places where even illumination is desirable.

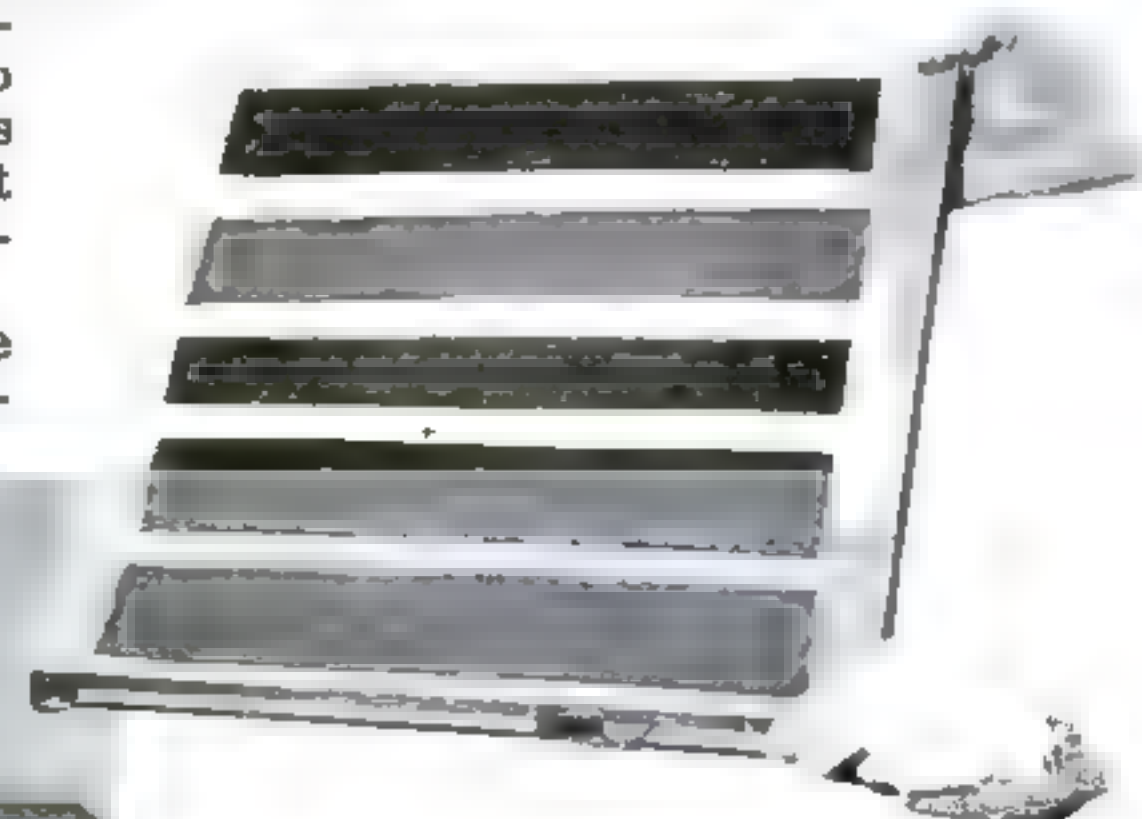
The reflectors could be made in various ways, but in this case a hole was bored through a piece of wood, the ends were plugged, and the outside was turned to form a tube $\frac{1}{4}$ in. thick. This was split from end to end, and the inside was finished with aluminum paint. Suitable tops and bases were turned from wood, and the bases were bored out and loaded with lead. The special sockets sold for use with the lamps were machined to fit the curve of the reflector.

Rubber Strips Improve an Enlarging Easel

MANY enlarging easels are equipped by the manufacturers with four rubber buttons nailed to the underside at the corners. These are intended to keep the easel from sliding around on the enlarging table and theoretically they are a good thing. However, in composing and focusing the enlargement on the easel, it frequently happens that the easel overhangs the baseboard of the enlarger and is supported by only two or three of these buttons. This causes the easel to seesaw or to tilt out of level, and either is most annoying.

To correct this difficulty, remove the rubber buttons and glue on sev-

eral 2- or 3-in. wide strips cut from an old automobile inner tube, keeping the rougher side outwards, as shown in the illustration below. These strips, uniform in thickness, support the easel evenly regardless of its position on the baseboard, and since they are made of rubber, the easel will not slide off.—C. E. BLACK.

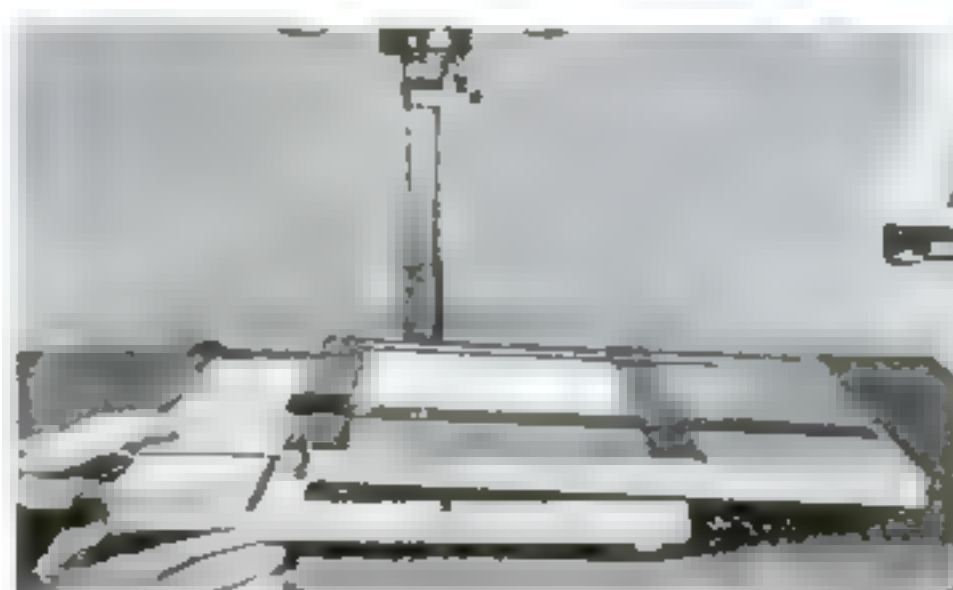


When an enlarging easel has rubber buttons on the bottom, it will tilt as shown at the left. Rubber strips, above, prevent this



Thermometer Holder

A DARKROOM or chemical thermometer may be protected from breakage yet kept handy by making a holder from a short length of rubber tubing. Leave a tab at the top for fastening the tube, and bind the lower end with several turns of wire, but leave an opening large enough for drainage and to facilitate cleaning.—K.M.S.



Famous KODAK BANTAM SPECIAL

now \$87.50



FEATURES

LENS—Kodak Anastigmat EKTAR $f.2.0$, extra-fast, super-corrected.

SHUTTER—Compur-Rapid, 9 speeds to $1/500$ second.

COUPLED RANGE FINDER—Military type; split-field; finds the range and focuses in one operation.

FILM-CENTERING DEVICE—Locks film accurately in position for each exposure.

KODAK BANTAM SPECIAL'S great reception by amateur photographers makes possible this substantial price reduction. "Buy of the year" at \$115, it is now only \$87.50, including leather field case.

If that's about your price, then this is certainly your miniature. Extra-fast lens. High-speed shutter. Built-in range finder. Handles with delightful ease. Master of every miniature shot. See it at your dealer's.

FULL COLOR . . . Load Kodak Bantam Special with Kodachrome Film and get gorgeous full-color transparencies, to be viewed as they are, or mounted in slides for large-size projection in the Kodaslide Projector . . . Eastman Kodak Company, Rochester, N.Y.

FIELD CASE

Kodak Bantam Special's new low price includes a tan sole leather sportsman's field case which allows you to carry the camera on a neck strap—ready for use without complete removal from the case. A great convenience for "rapid-fire" picture taking.



KODAK MINIATURE ENLARGER, MODEL B, is a useful miniature camera accessory. Blows up your miniature negatives to 100 times original negative area, or to even greater proportions. Has an $f.4.5$ Kodak Anastigmat lens and many outstanding features, yet is priced as low as \$52.50. Ask your Kodak dealer today for the complete details.

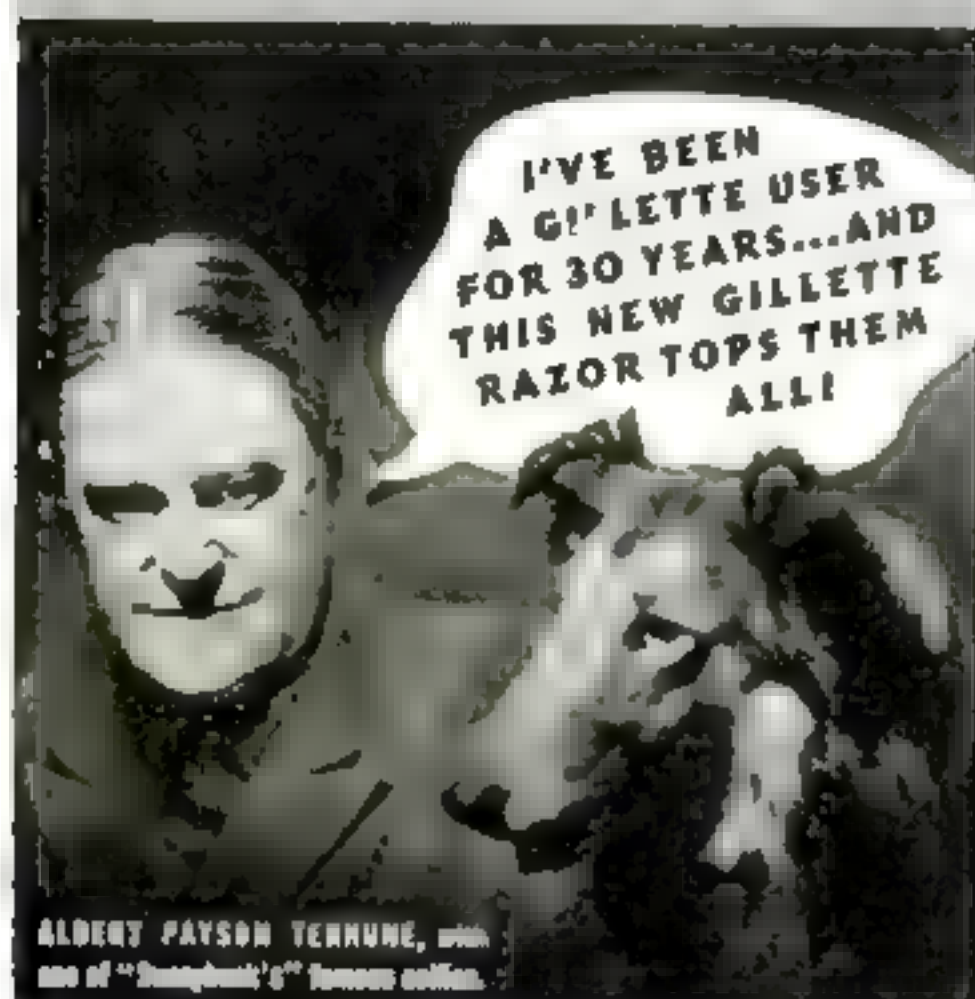


For BLACK-AND-WHITE PICTURES, Kodak Bantam Special loads with either Kodak Panatomic or Kodak Super X Film—the former for negatives of exceptionally fine grain that permit an astonishing degree of sharp enlargement; the latter for indoor shots, or short exposures outdoors, where high film speed is essential.

For FULL-COLOR SHOTS, you choose from two types of Kodachrome Film—regular, for daylight; Type A, for Photoflood or Photoflash exposures.

*Only EASTMAN
makes the KODAK*

FAMOUS AUTHOR SAYS:



AMAZING NEW ONE-PIECE GILLETTE RAZOR 69¢

COMPLETE WITH FIVE BLADES

WITH a 30-year background of Gillette shaving satisfaction, Albert Payson Terhune speaks from experience when he calls this Gillette One-Piece Senator "the greatest razor of them all!" At 69 cents, including five Gillette Blades, here's the most amazing value in Gillette history. You change blades in three seconds! Twist the handle—and it's open. Another twist—it's closed, ready for use. Sturdily built, heavily nickel-plated, it's designed to hold Gillette Blades in perfect alignment and give you clean, comfortable shaves that last!



More Comfort For Your Money
Gillette has invested millions in equipment to produce uniform blades that fit your Gillette Razor accurately. Always insist on Gillette Blades. They give you the world's best shaves for less than 1¢ a day.

Gillette's New Brushless Shaving Cream

Prepare your beard for perfect shaves with Gillette's New Brushless Shaving Cream. Made with peanut oil, it softens wiry whiskers, stays moist, won't clog your razor. Try a large tube, only 25¢. You'll like it!



Gillette

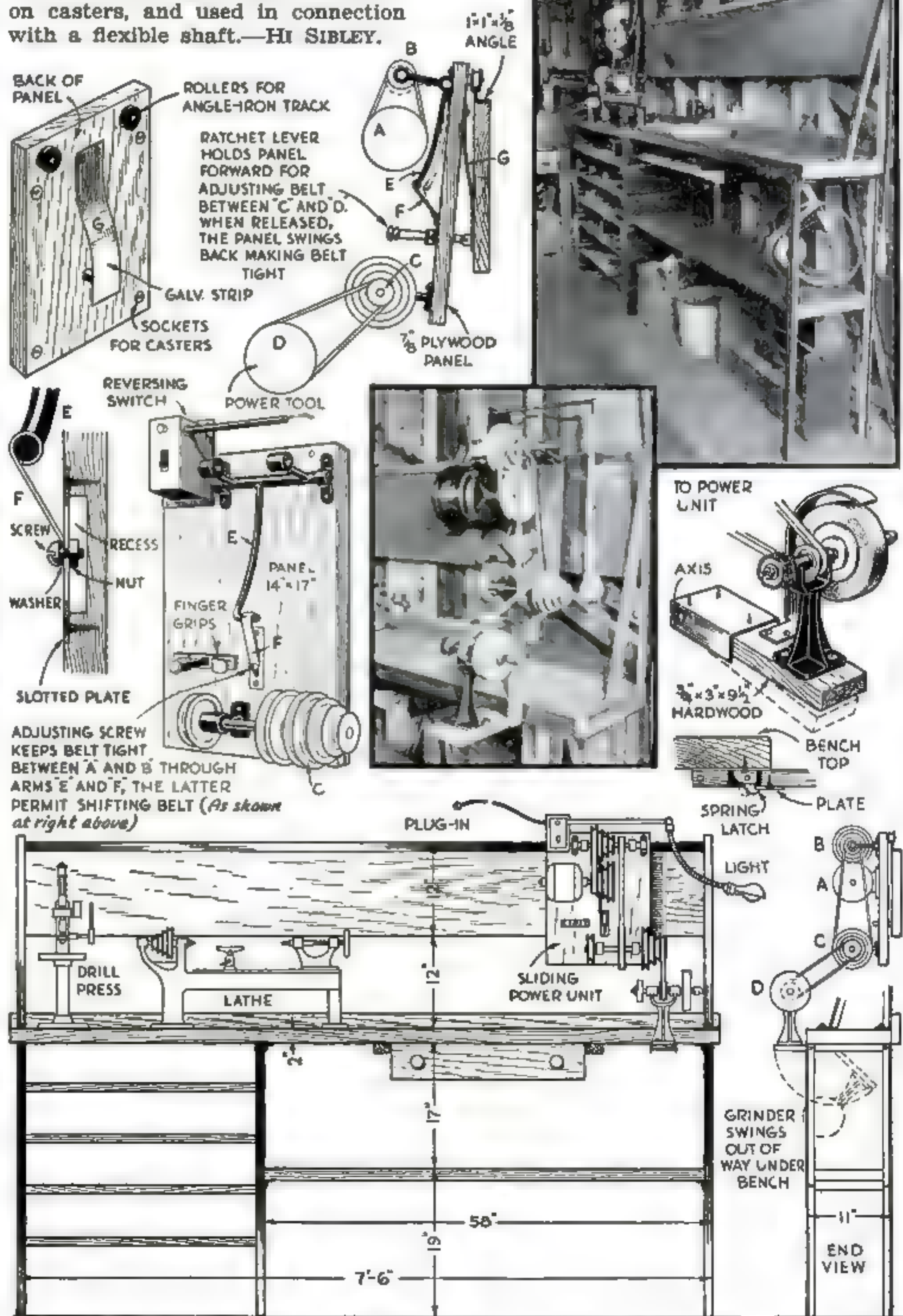
RAZORS AND BLADES

MORE SHAVING COMFORT FOR YOUR MONEY

Compact Workshop FOR A NARROW GARAGE

WHERE space is at a great premium, as, for example, in an exceptionally narrow garage, a compact home workshop can be installed as shown below. It was devised by Lloyd Singer, of Glendale, Calif., to enable him to drive in his car without splitting hairs, so to speak. The bench extends from the wall only about a foot, and, instead of a countershaft or several motors, there is a single sliding power unit. The latter has eight speeds and a reversing switch. In one view it is shown belted to a small grinder which, when not in use, swings under the bench. The power unit can easily be lifted off its track, mounted on casters, and used in connection with a flexible shaft.—HI SIBLEY.

Lifted from the track and set on casters, the power unit (above) may be used with a flexible shaft for any odd jobs



I Became a Head-Hunter

(Continued from page 31)

about three feet high at the shoulder. And what magnificent tusks these two carried! Here was one of the fiercest game animals in the entire world. Many a well-armed white hunter, using the best type of rifle, has gone down before their sudden and vindictive charge. And the Dyaks around me were going to attack them with only spears!

The two tuskers suddenly jerked up their hairy heads. I knew they had caught our scent. With a terrifying squeal like that of a trumpeting elephant, the boars turned and charged straight for us.

AS IF at a signal, an entire herd came out of the reeds in the lake. The earth seemed to quake under the weight of their numbers. Their grunts were terrible. Spears flashed on all sides. *Pedangs* (head knives) were whipped out of clanking wooden scabbards. Warriors began leaping like dark shadows toward the wounded, speared beasts, and with incredible speed hamstringed them, Dyak fashion.

For fear of hitting one of the hunters, I hadn't fired a shot from my rifle. The hunters had accomplished the kills almost before I had even seen one of the charging tuskers. Some of the Dyaks were slashing a clearing; soon they had dragged the boars to it. One of the Dyaks was badly gashed in the thigh, but was too intent on his work to notice. Probably he was thinking of the ceremonial events soon to come.

I saw that some of the spears had broken off in the boars. Five of the beasts had now been dragged to the clearing. From these the head-hunters obtained the heads to be used in the ceremony by which the strength and courage of the beasts was supposed to be transferred to the hunters. One warrior raised his hair-adorned knife and lopped off the head of a boar whose neck was as thick as a twenty-gallon barrel.

THE hunt was finished. Now for the greatest mystery in Borneo! The Lawangans tossed the bloody heads over their bare backs and we headed for the long-house. The meat of all but one boar had been left in the bush, since it could not be used as food owing to its ceremonial significance. When we reached the village the warriors hurried the heads to the head house. Here the trophies of the hunt were hung on poles already embedded in the ground before the entrance to that grim structure.

Women hurried to and from a nearby river with sections of giant bamboo. Old men squatted, blinking from the hot vertical sun, telling the young bucks how they would have taken the heads of *babi hutan* had they been on the job. What with their new-fangled ideas, the youngsters had in all probability bungled the job! As night approached, the devil-chasing drums be-

(Continued on page 91)

IT'S ALWAYS ZERO in the Delco Cold Room!



In this "cold room," where zero temperature prevails, Delco batteries are tested for performance to insure quick starting in cold weather.

In summer as well as in winter, Delco-Remy engineers and research men subject Delco batteries to cold-room tests at a temperature that never varies more than one degree from zero. Here, under approximate winter operating conditions, each part of a Delco battery is thoroughly checked, so that its cold-weather performance may be assured. It is this thoroughness in research and testing that assures battery users of quick starting, ample power, and long life from the Delco batteries in their cars, trucks, boats, and tractors.

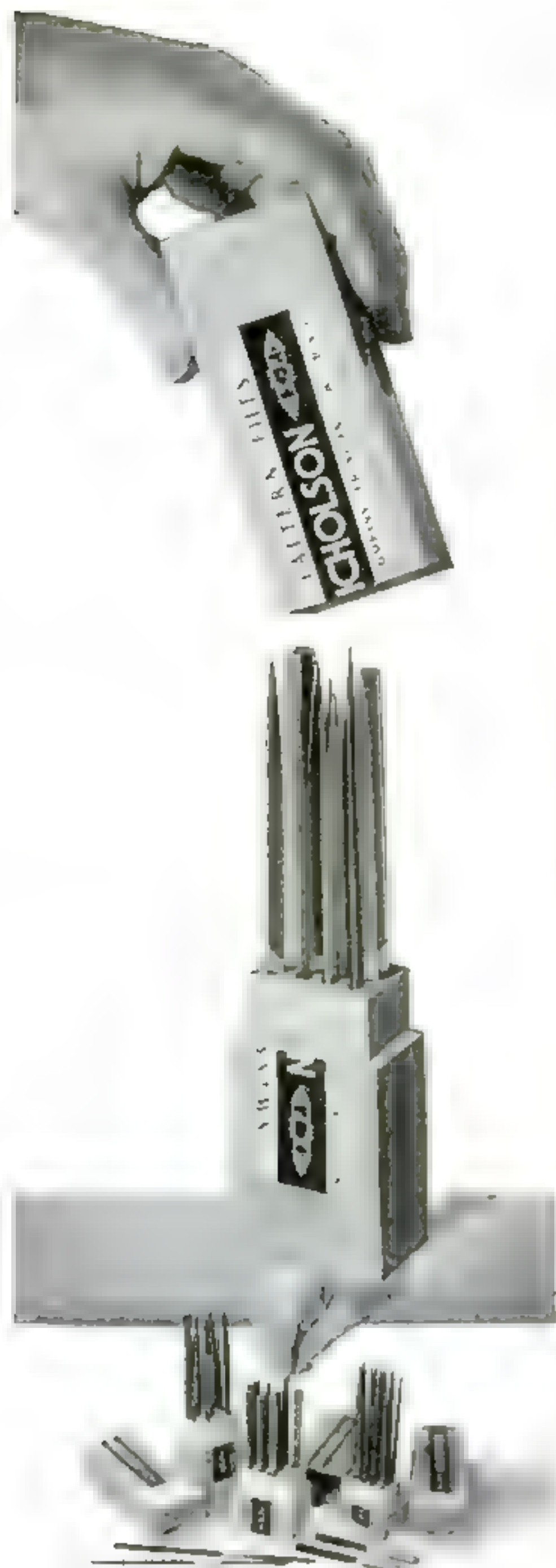
Delco battery sales and service requirements are available at United Motors Service Stations and dealers everywhere.



Delco-Remy

ANDERSON, INDIANA

World's Largest Manufacturer of Automotive Electrical Equipment



12 ASSORTED NEEDLE FILES . . . in a Box which becomes a Bench Stand . . .

You'll like this new, economical, convenient way to buy Nicholson X.F. Swiss Pattern Knurled Handle Needle Files . . . the files that will help you do the most delicate filing work with precision.

12 different-shaped files . . . a complete assortment for every delicate filing need . . . now available in convenient box. Lift off the top and the box becomes a handy bench stand . . . keeps files within easy reach and prevents them from rubbing.

You can equip yourself to do all types of precision filing by asking your hardware dealer for the new set of Needle Files in the box that becomes a bench stand. If he cannot supply you, write us direct. Nicholson File Company, Providence, R. I., U. S. A.

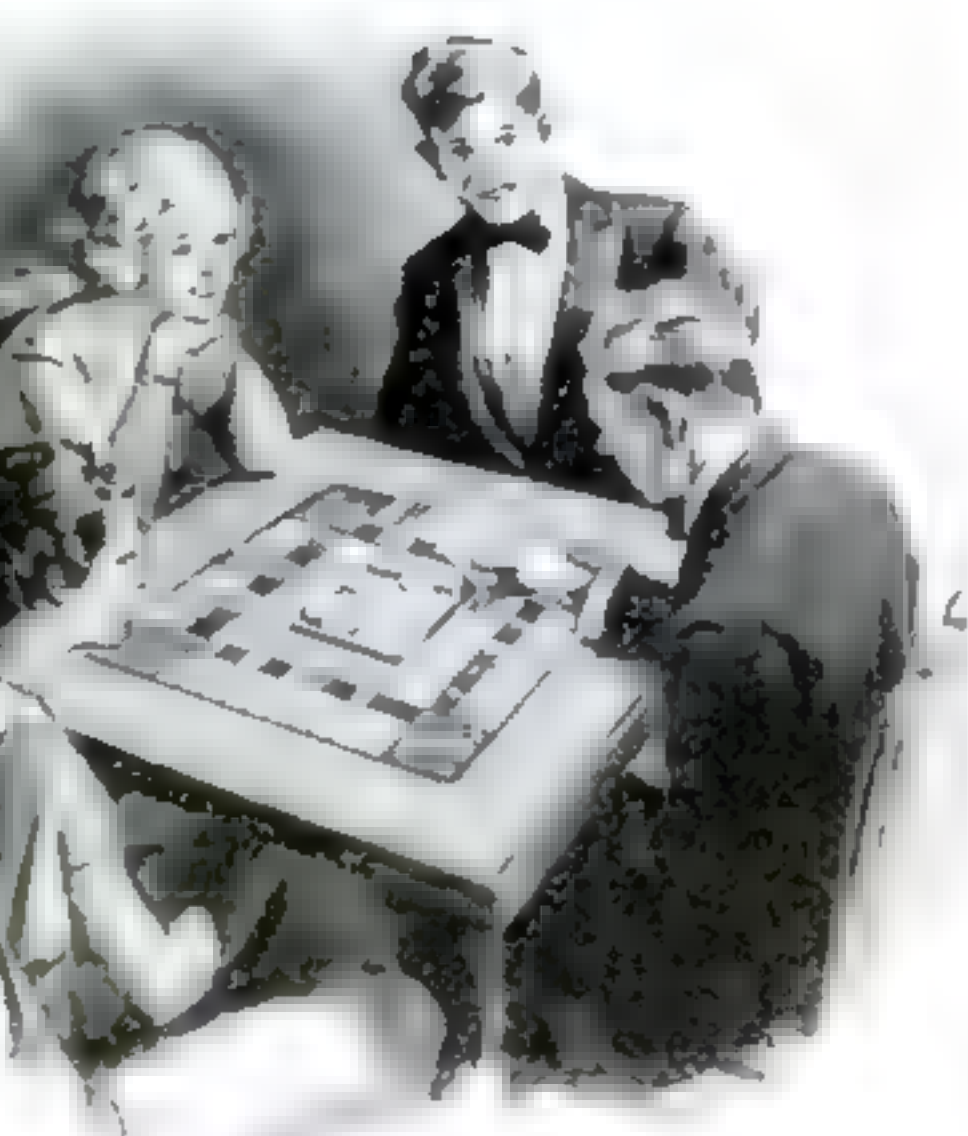
A FILE FOR EVERY PURPOSE

EXCITING NEW Letter-Matching Game MADE FROM CARDBOARD

"MAIL" is an exciting new game that can easily be made from cardboard. It is intended to be played by four persons.

The base is a heavy piece 16 in. square. It should be carefully laid out, colored, and lettered as indicated in the drawing below. The colors are for identification purposes and are applied in the small rectangles marked A, B, C, and so on. The A's, B's, C's have been placed on the diagram merely to serve as a color chart; they are not needed on the game itself. Note that while the designations "business," "introduction," and so on are placed in the same order on each side of the board, the arrangement of colors is different.

Glued to the center of the board is a scrambling tray of medium weight cardboard. The "letters" or "envelopes" are represented by forty-six lightweight cardboard slips. There is one letter cor-



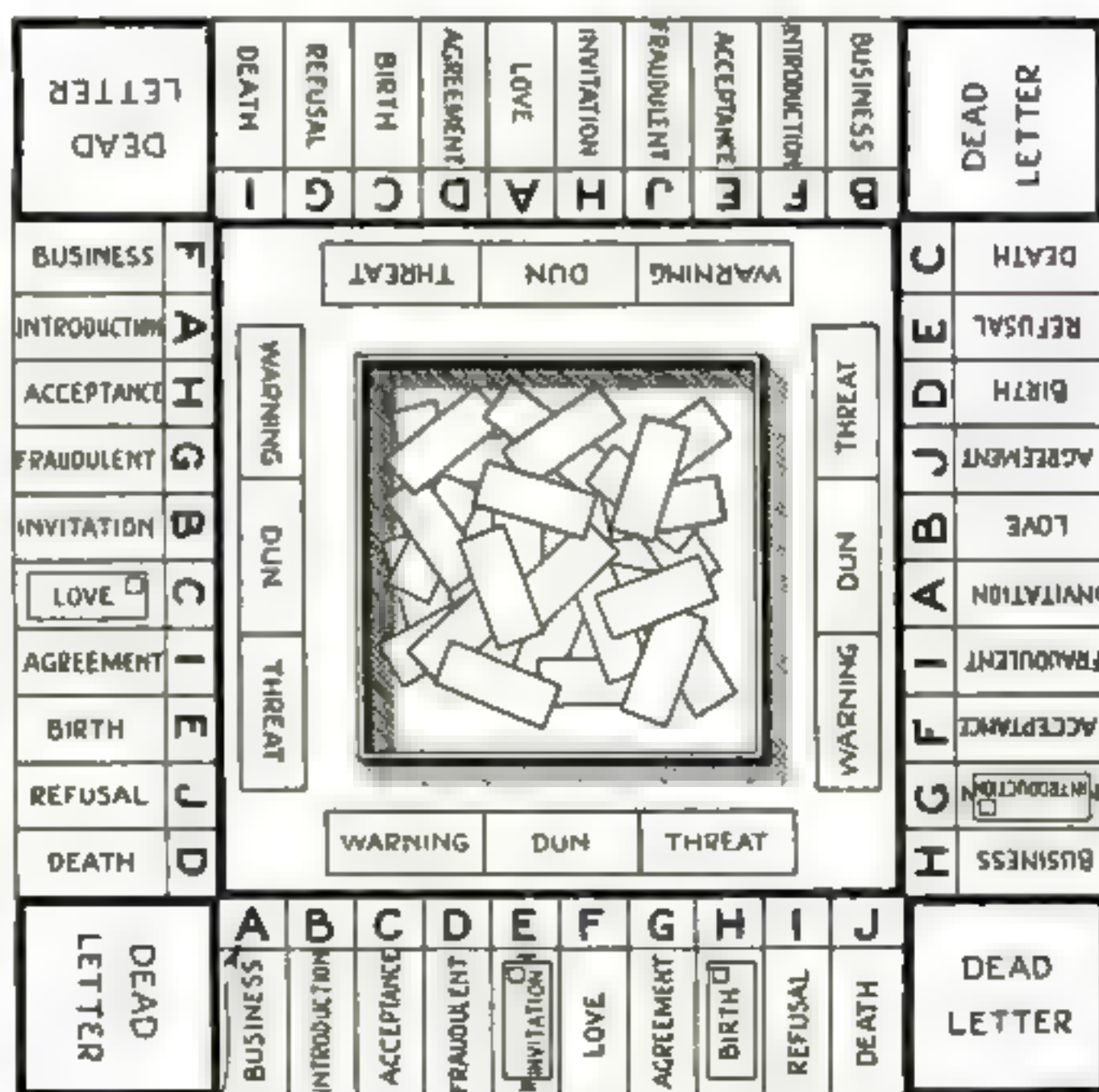
"Envelopes" are identified by "address" and color of "stamp"

responding in name to, and bearing a painted "stamp" to match the color of, each of the forty outer spaces. There are also two letters each marked "warning," "dun," "threat," and bearing a red stamp.

After the slips have been placed face down in the scrambling tray and thoroughly mixed, one of the players picks out a letter. If it matches one of the spaces on his side of the board in both name and color, he lays it on that space. If it does not match, he puts it in the "dead letter" space at his right. The next player then takes his turn, and this continues until the tray is empty. The players then either put all the dead letters back in the tray and keep on drawing, or else exchange the piles of dead letters.

When all letters are drawn, either method may be used over and over until a player wins by filling all of his outer spaces.

The inner spaces (warning, dun, and threat) need not be filled. If, however, a player fills all of his inner places at any stage, he must put every letter he has back and begin over again at the next turn. If a player places three outer letters in succession, he is allowed an extra turn.—D. W. C.



PAINT EACH SQUARE A DIFFERENT COLOR

A - RED D - VIOLET G - BROWN J - BLACK
B - DARK BLUE E - PINK H - YELLOW
C - ORANGE F - GREEN I - LIGHT BLUE

HEAVY CARDBOARD BASE - 16" SQ.
TRAY 6" SQ.

46 "LETTERS", THIN CARDBOARD - 3/4" x 1 3/8"

How to lay out and paint the base; edge view showing the tray in center; and one of the set of small slips used in playing



Chain Steadies Small Camera

FOR amateur movie photographers and those who use small still cameras, the chain device illustrated is a convenient substitute for a tripod.

Remove the reflector and socket assembly from a small flash-light case and solder a disk of heavy brass in place of the lens. Wire a 6-ft. length of brass chain to the head of a $1\frac{1}{4}$ by $\frac{1}{4}$ -in. stove bolt. Fasten a short cord to the flash-light cap with a small machine screw, and the other end to the inside of the case. Attach the flash-light case to the camera with a nut on the outside, next to the camera, and a wing nut on the inside of the case. The chain is carried in the handle.—ALVIN C. PORTER.



Rigging the 'Alabama'

(Continued from page 65)

holes in the ends through which the guys pass. The guys are then fastened to eyes in the ship's sides.

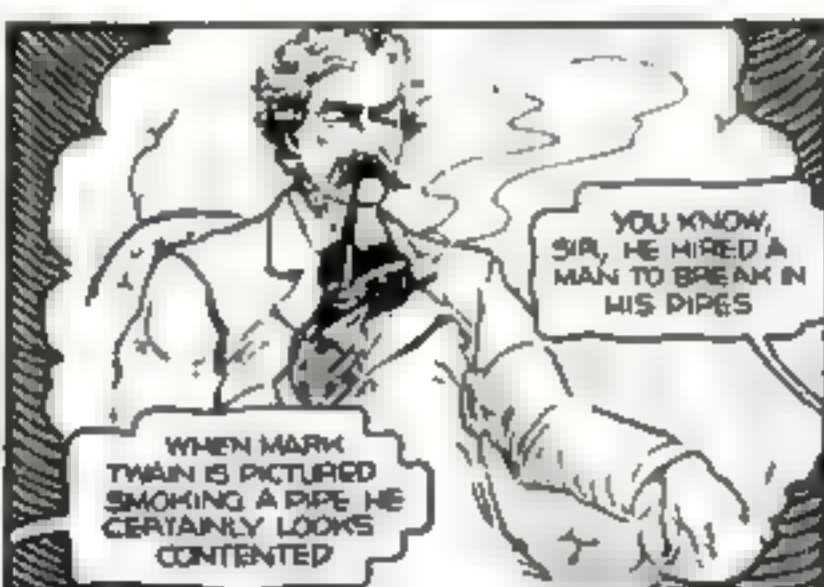
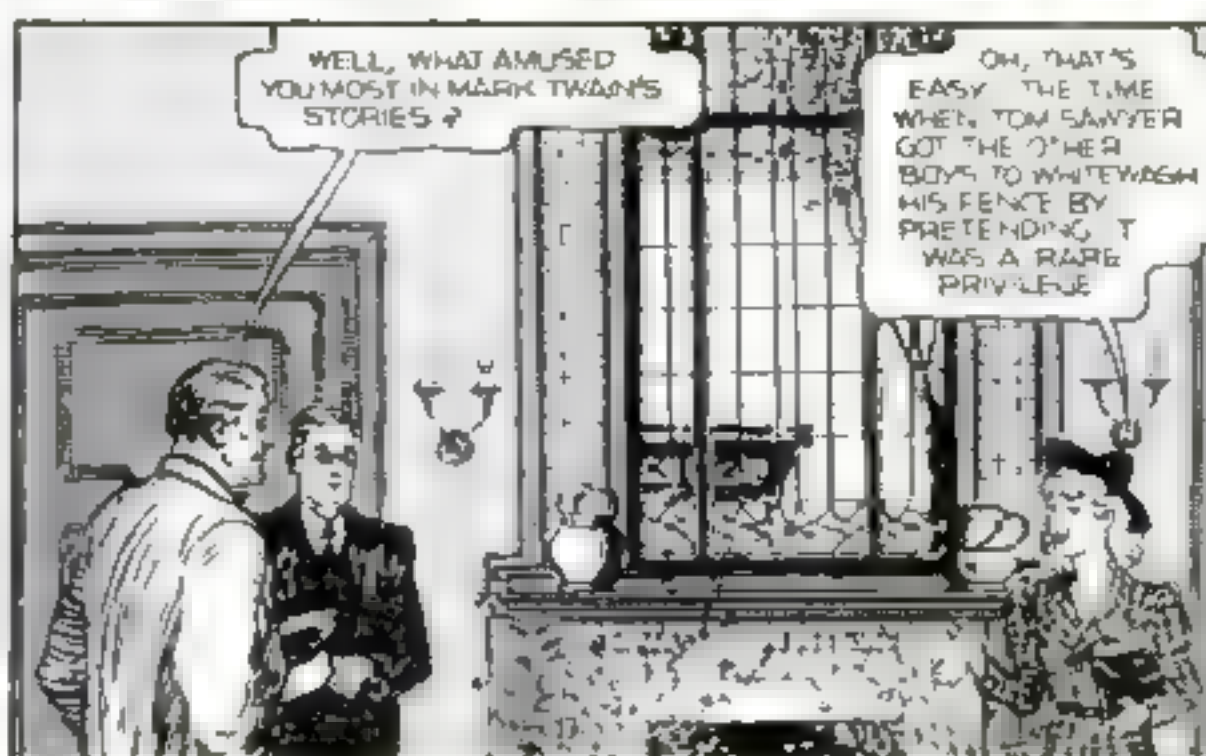
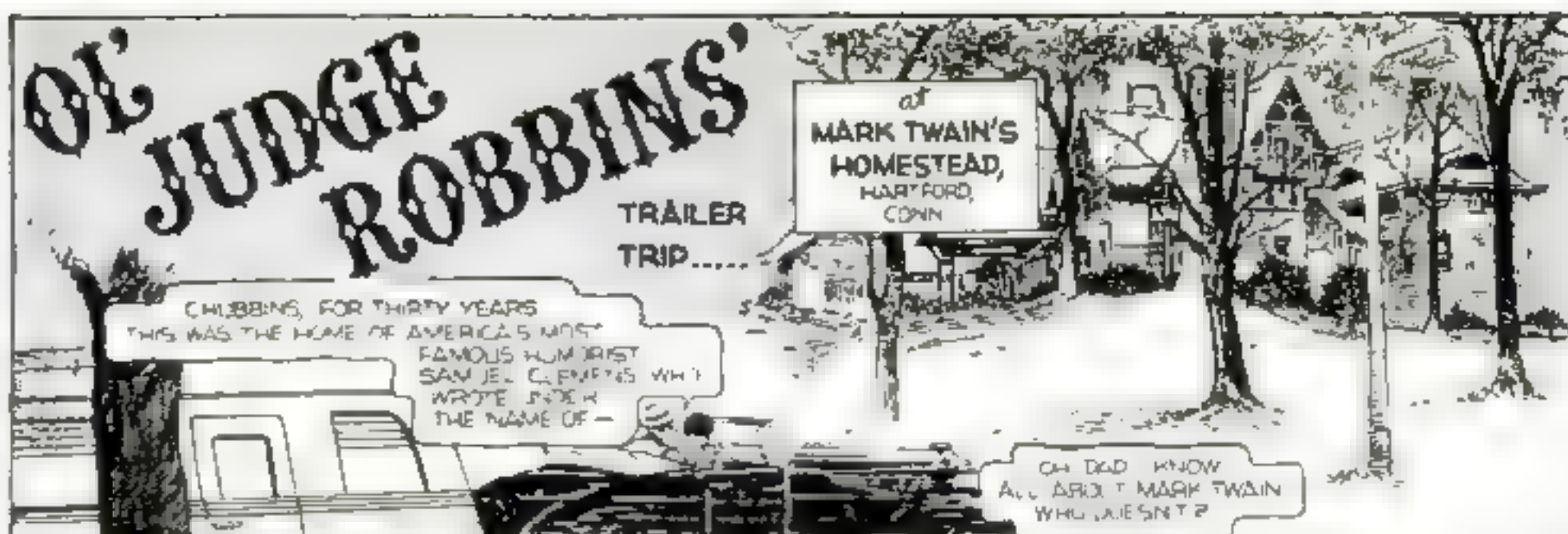
Send aloft the topgallant-royal masts. Rig double (three-wire) shrouds on each side from the topgallant masthead, passing through the ends of the crosstrees and around the topmast shrouds below, where they are turned up and seized. One backstay at each side leads to $\frac{1}{8}$ -in. deadeyes at the rail.

The mizzen topmast has shrouds from the shoulder to the crosstrees, and backstays both from the shoulder and from the topgallant masthead. There is, however, no topmast stay.

The lower yards may now be what is called "crossed" by slipping the bolt previously described in position and fastening the chain slings. First, however, I should reeve off the topsail sheets. These should be thin chain of not more than eighteen links to the inch, each $6\frac{1}{2}$ in. long. They reeve through the yardarm holes and through the blocks under the yards. The ends hang down and have a cord (marked size e in the list) spliced to them. The cords lead through holes in the sheet bitts, to which they are hitched.

The topping lifts to hold the yards horizontal have blocks at the yardarms and others fastened to holes in the caps. I have always found it easier to strap blocks for use in such positions, leaving long ends. Reeve off the tackles, draw blocks to position, and tie.

(TO BE CONTINUED)



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TASTE THAT RICH TASTE! MARVEL AT THAT EXTRA MILDNESS!



PUT THAT P.A. CRIMP CUT TO WORK FOR YOU. SEE HOW MUCH BETTER IT PACKS, DRAWS—HOW MUCH COOLER IT SMOKES!

FATHER'S DAY—JUNE 19th

Is dad a pipe-smoker? Here's the ideal gift for him—a pound or half-pound of extra-mild, extra-tasty Prince Albert, in a neat red tin. Will dad be mighty pleased with that? Just try it and see!

50

pipefuls of fragrant tobacco in every 2-oz. tin of Prince Albert

PERFECT SMOKES—OR NO PAY!

Smoke 20 fragrant pipefuls of Prince Albert. If you don't find it the mellowest, tastiest pipe tobacco you ever smoked, return the pocket tin with the rest of the tobacco in it to us at any time within a month from this date, and we will refund full purchase price, plus postage.

(Signed) R. J. Reynolds Tobacco Co., Winston-Salem, N. C.

ALSO FOR FASTER-ROLLED NEATER "MAKIN'S" CIGARETTES



PRINCE ALBERT

THE NATIONAL JOY SMOKE



**What-
NO ALKA-
SELTZER
IN THE
HOUSE!**

**Don't
LET THIS
HAPPEN
IN YOUR
HOME**

IT certainly is disappointing to wake up with a headache or an upset stomach, and find there are no Alka-Seltzer Tablets in the house.

This often means having to start the day feeling miserable, when, had Alka-Seltzer Tablets been available, you could just drop one in a glass of water and quickly have a sparkling glass of Alka-Seltzer that would relieve your trouble promptly.

Alka-Seltzer gives relief in **TWO** ways—its analgesic properties promptly relieve the pain and because it is one of the best alkalizers known, it helps correct the excess acid condition so often associated with common ailments. *Sold by all druggists in 30c and 60c packages*

**BE WISE-ALKALIZE WITH
Alka-Seltzer**




BUILD YOUR OWN AIR CONDITIONING

Cool in Summer—Warm in Winter. Saves 25% of coal bill! Changes and Cleans the air in your home 5 times every hour. Build for less than \$18.00 unit costing \$250.00. No better unit ever designed. Send only \$3.00 for detailed plans or 10c for information. Money back guarantee.

H. W. HERRON, Heating Engineer
134 N. Wyman St., Room 16, Rockford, ILL.

**Earn Wood-working \$\$
IN YOUR SPARE TIME!**



Learn how you can build up a profitable spare or full time business in your own home. This new book "How to Make Money in Woodworking" is crammed with practical tested ideas, plans, and suggestions. Tells you exactly what to make, how to make it and how to sell it. Describes plans that have worked for others. Woodworking, the new way, is light, pleasant and profitable. Send only 10c and complete book will be mailed postpaid. Satisfaction guaranteed or money refunded. Write to Dept. B738.

Delta Mfg Co. 600 E. VIENNA AVE. MILWAUKEE, WIS.



As soon as the cutting edge is sharp, the drill is lowered to grind the clearance

IT'S EASY TO LEARN HOW TO Sharpen Twist Drills

A HIGH degree of accuracy is required in order to sharpen a twist drill properly, but the procedure is easily learned, and accuracy comes with practice.

The grinding wheel should be of a modern type such as aluminum oxide (usually a reddish brown color). A grain

size of 60 to 80 is generally used for sharpening small tools.

Grinding may be done either on the face of the wheel or on the side, but it must be straight and clean. An emery wheel dresser should be used when needed. Since the side of the wheel is usually in better condition and it is easier

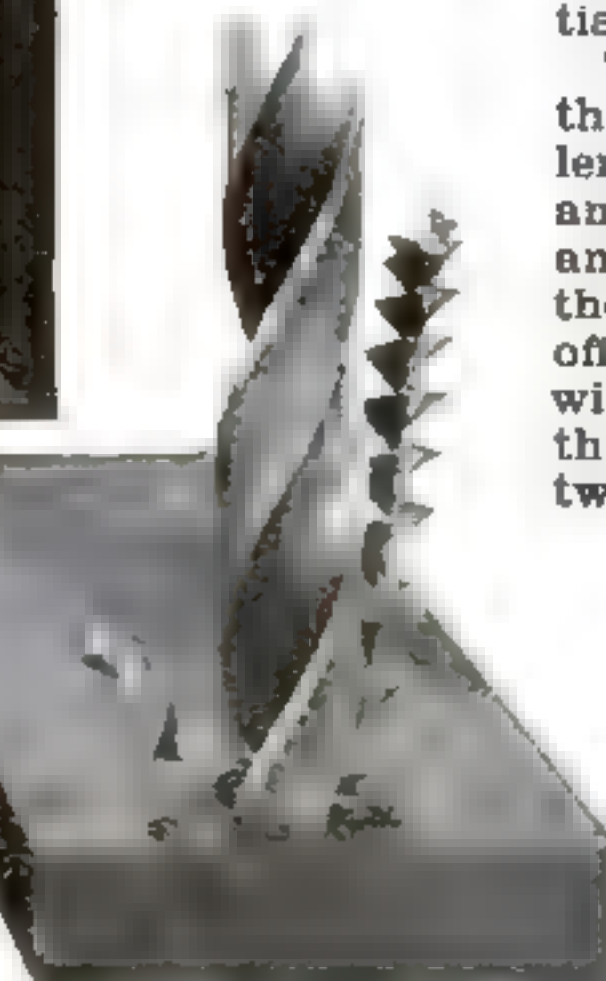
to learn to judge or measure the angles on the side than on the face, the side method will be described, although it is not always considered to be technically correct.

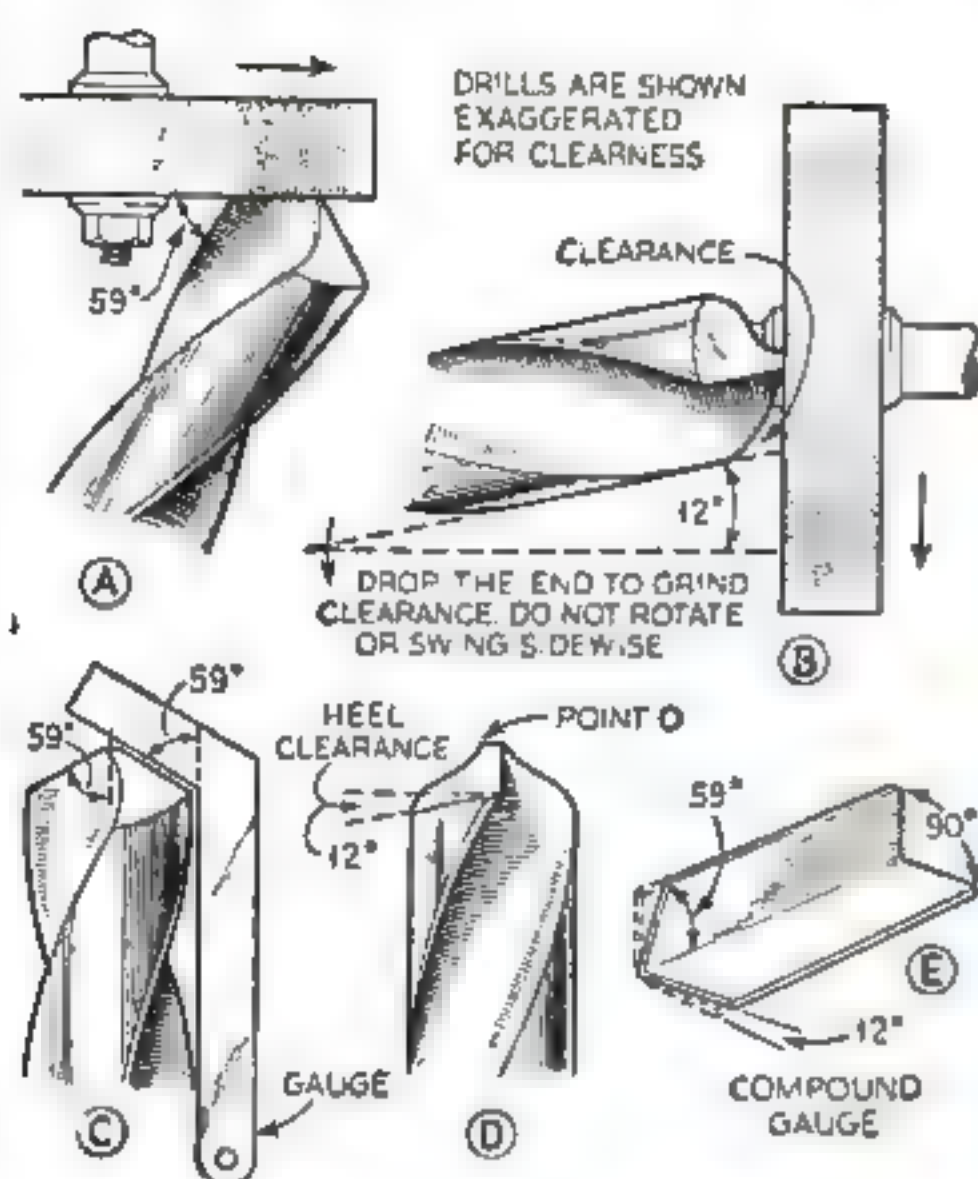
The correct angle between the cutting edge and the central axis of the drill is considered as 59 deg. in the United States (shown in diagram A). However, the English use 60 deg., and as it is easier to lay out a 60-deg. angle on gauges, it is a common practice to use 60 deg. A gauge, which may be made of tin or any light sheet metal as at C, is essential for doing good work.

The two cutting edges of the drill must be of the same length as well as the same angle. If they are the same angle but not the same length, the point of the drill will be off center, and the drilled hole will be of larger diameter than the drill. If the drill turns two spiral shavings the same size when drilling mild steel, the angles are the same and the lengths of the cutting edges are correct. This does not guarantee, however, that the drill will work well because the clearance angle also must be correct.

By
**M. A.
SHARP**

Testing the angle with gauge. The views below show shavings from a properly ground drill compared to those from one sharpened poorly





Sharpening angles and two types of gauges

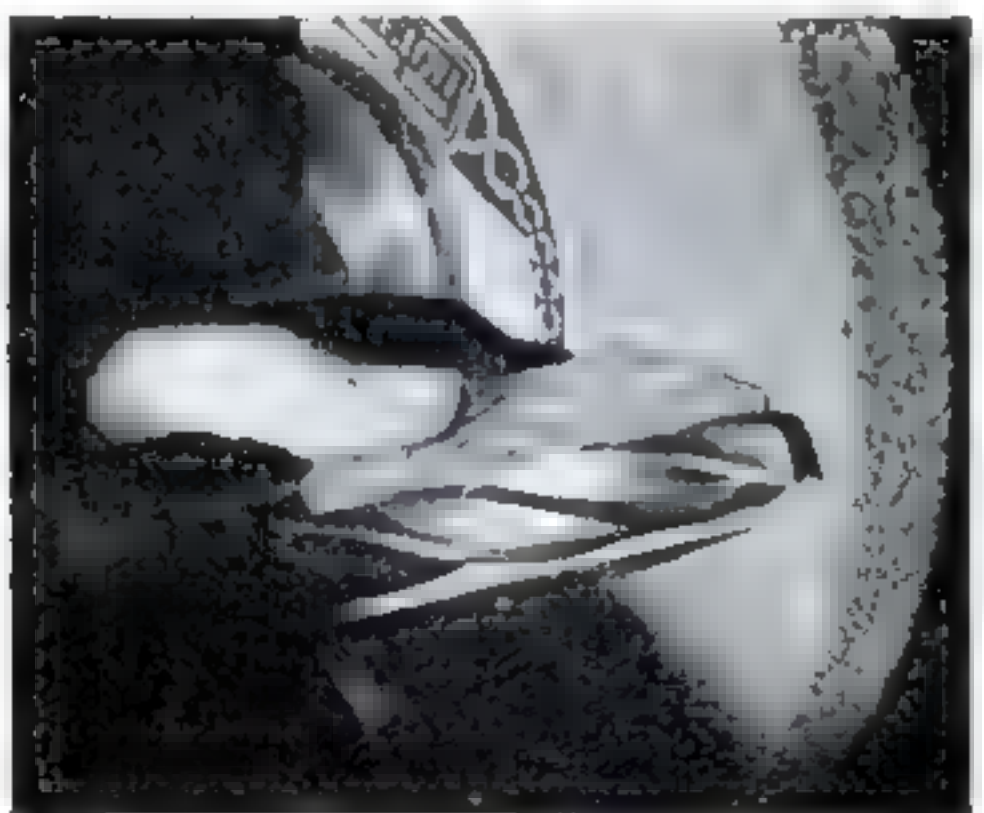
The accepted standard clearance angle (diagram B) is 12 deg. In drilling brass, it is common practice to reduce this angle to zero at the cutting edge and for about 1/64 in. back. In drilling lead or babbitt, the angle may even be reversed.

The position of the drill against the grinder should be as shown. The 59-deg. angle may be checked with a triangular file or a small triangle made of sheet metal. This angle may also be marked on the bench beneath the grinder, or a wire may be attached to the grinder and bent to the correct angle. The edge being ground must be horizontal and preferably about even with the center of the wheel. The other angle at which the drill must be held—12 deg. in the vertical plane—may be measured with a small triangle of sheet metal.

A simple but effective gauge (E) for getting both of these angles at once is shown in use. If fastened rigidly so it just clears the grinding wheel, the gauge may be left in place to save time.

Having checked the angles carefully, start the grinder and hold the drill lightly against the wheel. As soon as the cutting edge is sharpened, slowly lower the opposite end of the drill, grinding the clearance angle. As the end is lowered, the cutting edge is pulled away from the wheel so the point O is not ground off the cutting edge opposite the one being sharpened. If the end is lowered too slowly, the clearance angle may be more than 12 deg., and the cutting edge will chip away under use. If the end is lowered too quickly, there may not be sufficient heel clearance.

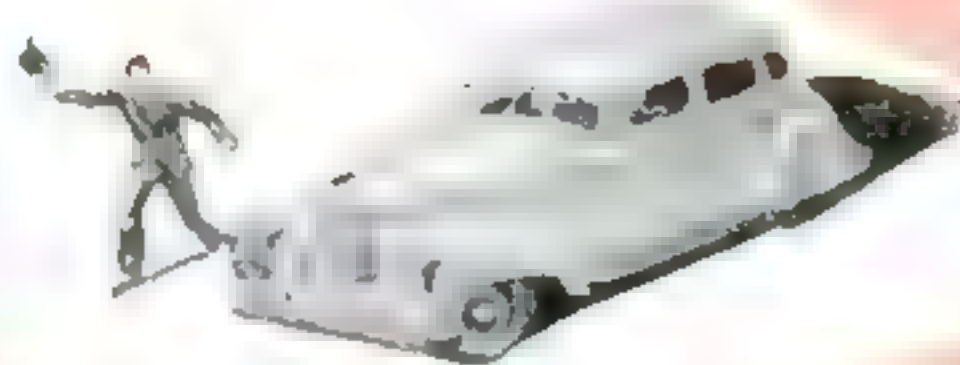
The drill should not be rotated while being ground, and the cutting edge being sharpened must be horizontal or slightly high at the point end.



How the compound gauge is used as a guide



YOU CAN DEPEND
ON CHAMPIONS



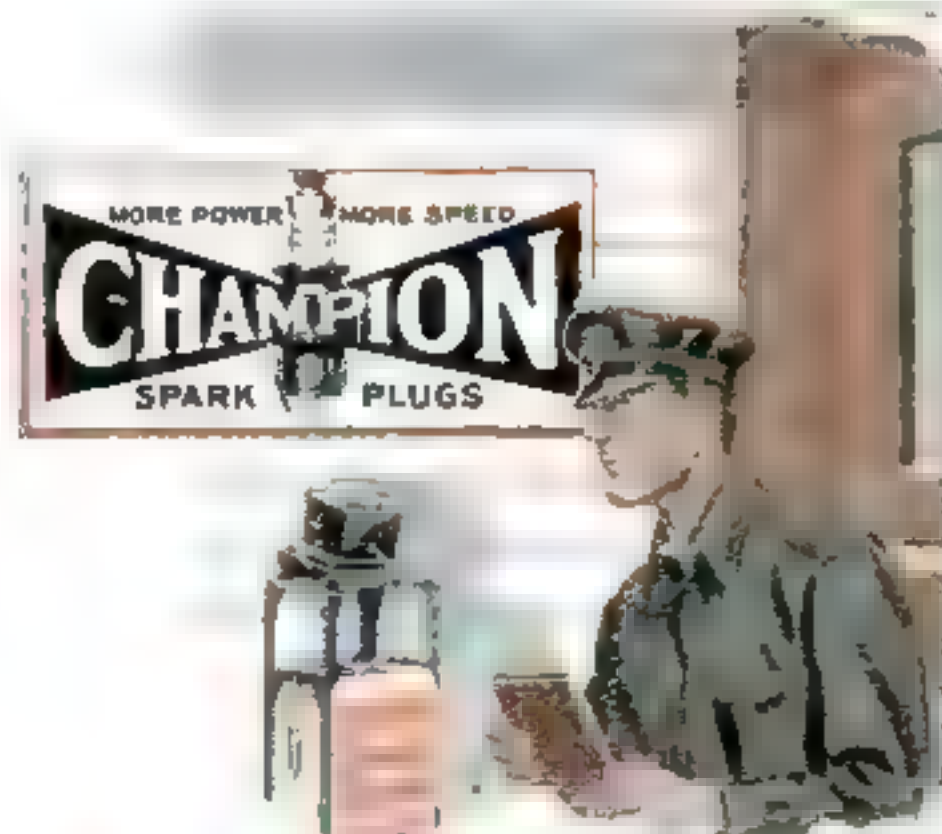
FOR MAXIMUM ECONOMY

Under the strict surveillance of the A. A. A. Contest Board, 26 stock cars recently left Los Angeles for Yosemite National Park, 314.5 miles away. Every car was carefully prepared for, and every driver was intent on, one thing only—extracting the most miles per gallon out of every gallon of gas.

This was the third annual Gilmore-Yosemite Economy Run, a real test of engine efficiency and economy. The route is not conducive to good mileage, including as it does almost 100 miles of winding mountain highway and climbs reaching an elevation of over 6000 feet. The "stingy drivers", as they are known, furnished proof positive that engines equipped with Champion Spark Plugs get maximum miles per gallon.

The Sweepstakes winner in this event set a new record with Champion Spark Plugs. Eight out of ten first places in various classes went to Champion-equipped cars. For maximum economy in your car re-

place worn-out spark plugs with new Champions and you'll quickly save their cost in extra gas mileage. Wherever you find dependable service, you'll find a dependable Champion dealer.



The Sign of Dependable Service

CHECK AND CLEAN SPARK PLUGS WHEN YOU CHANGE OIL

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SOUTH BEND LATHE WORKS

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(Continued from page 62)



Floyd Lewis, of the Muskegon club, addressing a large meeting in the school shop

Projects exhibited at a recent meeting of the *Edmundston (N. B., Canada)* Hobbyists Club included a bedside table by R. Nadeau; combination stool and stepladder, C. LeBel; fret-saw work, R. Bernier; glue joints, R. C. Flewwelling. P. Powers spoke on how geometric figures can be applied to wood working. A women's auxiliary may be established soon.

John Nick has been elected president of the Passaic County Homeworkshop Club, *Hawthorne, N. J.*; Bill Anderson, vice president; Leopold Wroblewski, secretary; Henry Ceier, librarian. Among the projects being made by members are a fruit bowl, pipe rack, nut bowls, sewing cabinet, desk, book-cases, table and chair, boat model, chimes, chest of drawers, sewing box, and whatnot.

New officers of the Civic Homeworkshop Guild of **Fort Wayne, Ind.**, are William N. Ballou, president; A. H. Stoner, vice president; A. M. Smith, secretary-treasurer; Ernest Bower, librarian; L. N. Smith, C. E. Howe, N. C. Gresley, and F. J. Exner, board of governors. A demonstration of spindle turning and French polishing was given by C. A. Bex. An auction of workshop projects was held recently.

Joseph Mazur, a local foundry operator, demonstrated how to mold and cast aluminum before the Tri-City Homeworkshop Club of *LaSalle, Peru,* and *Oglesby, Ill.*, at the home of J. C. Rucinski . . . Each member of the

The Handicraft Club of Milwaukee, Wisc., had an exhibition at the Hobby Council Show. Much enthusiasm has been aroused over home workshop machinery to be awarded soon for the best projects made this season. Recent programs have included talks on wood turning, finishing, gluing, and uses of woodworking machines.

Clarence Crane demonstrated how to make metal ornaments and exhibited some of his metal sculpture at a joint meeting of the Arts and Crafts Guild and the *Niles (Calif.)* Homeworkshop Club. E. F. Glassbrook spoke on woodcraft, Dr. T. C. Wilson on gold casting, Doremus Scudder on miniature trains, and G. P. Vlery on the history



The officers and some of the members of the Staley Handicraft Club, Decatur, Ill.

A ship-mast lamp made by L. E. Foglesong, secretary of the *Saginaw (Mich.)* Homecraft Club, won first prize in a popular vote contest sponsored by a local department store; a knee-hole desk won second prize for M. Hedrick; third prize went to E. Deford for an inlaid serving tray.

Will Walton spoke on furniture at a meeting of the Kerrisdale Homeworkshop Club, *Vancouver, B. C., Canada*, and donated several books on the construction of period furniture for the club's library . . . Except for furniture, the clubroom of the Bison Homeworkshop Guild, *Buffalo, N. Y.*, is completed.

(Continued on page 89)

Clubs Aid Craftsmen

(Continued from page 88)

T. Roberts and F. Paul were awarded prizes in the monthly project contest. M. P. Bergen spoke on the origin of the word "guild" at a recent meeting . . . The *Fairmont (W. Va.)* Homecraft Club participated in a "Hobby Day Tea" sponsored by the Fairmont Woman's Club.

The *Eugene (Ore.)* Craftsman Guild recently visited the shop of W. I. King, who exhibited his carvings and demonstrated how to use the bow and arrow. He showed how he makes archery equipment, including the symmetrical singeing of feathers with an electric wire. The club was invited to meet with the Robin Hood Club and learn more about archery. Dr. James D. Stewart, president, has just completed an operating table for use in bone surgery. Dr. Wright B. Lee, secretary, made a large plywood book in which to keep the Guild job sheets. Eight boats are being built under the supervision of John Johnson.

A power saw, sander, drill press, large bench, cabinets, and shelves have been installed in the *Nutley (N. J.)* Homeworkshop Guild's workshop, which is rapidly nearing completion in a garage owned by Samuel J. Anderson. George H. Wild gave a scroll-saw demonstration at the May meeting.

Wives, sisters, and other women friends of members of the *Ottawa (Ont., Canada)* Society of Model Engineers sponsored a card party to raise money for additional equipment that cannot readily be built in club shops.

Joseph Schile, of the *Granlea (Alta., Canada)* Homeworkshop Club, has been experimenting with guitar construction. Arnold Friedenbergh enlarged his workshop and built a large workbench having drawers that open from either side. Many of the members attended a tractor school last winter.

Edward Gosselin demonstrated spindle and faceplate turning at a meeting of the *Ware (Mass.)* Homeworkshop Club.

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- Canoe, 16-ft. canvas-covered kayak, with sail, 192-193-194-R..... 1.00
- Fisherman's Outboard Boat, 9 ft. 3 in. or 11 ft. 6 in. long, for motors from 3 to 16 h.p.; can also be rowed, 344-345..... .50
- Folding Duck Boat, 13 ft. long, 170-R..... .50
- High-Speed Boat for Small Outboard Motors (7 ft. 11 in. long), 257-R..... .50
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- Motorboat-Rowboat, 16 ft. long, decked hull, for use with outboard or inboard drives or oars, 149-R..... .50
- Racing Runabout (13 ft. long, for outboard motor), 261-262-R..... .75
- Racing Sailboat Blackcat (13 ft. 4 in. long, 5 ft. beam, weighs 250 lb., Marconi rigged), 321-322-323-R..... 1.00
- Sectional Rowboat, 9 ft. 8 in. long, can be used with small outboard motor; all wood construction, 340-341-R..... .75
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- Utility Rowboat, 13-ft., (can also be sailed or driven by outboard motor), 224-R..... .50



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- Brig Malek Adhel (20-in. hull; frame-and-plank construction), 304-305-306-R..... 1.25
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- Freighter, Ocean (14-in.), 271..... .25
- H. M. S. Bounty (8 1/2-in. hull), 254..... .25
- Liner President Lincoln (14 3/4 in.), 325..... .25
- Mayflower (24 in.), 83-84-85-R..... 1.00
- New Bedford Whaleboat (14-in.), 326-R..... .50
- Privateer Swallow, Baltimore clipper, (13-in. hull), 228-229-230-R..... 1.00

- Racing Yacht Seascout (42-in.), 106-107-R..... .75
- Sovereign of the Seas, clipper ship (20 1/4-in. hull), 51-52-53-R..... 1.00
- Spanish Treasure Galleon (24 in.), 46-47..... .50
- Trading Schooner (17 1/2-in. hull), 252-253..... .50
- U. S. Battleship Texas (3-ft. hull), 197-198-199-200..... 1.00

(Construction kits are available for some of these models. See page 18.)



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- Bed and Armchair Table, 333A..... .25
- Bookcase, modernistic, 88..... .25
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- Silverware Chest on Stand, 256A..... .25
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- Tea Wagon (turning), 13..... .25
- Telephone Table and Stool, 18..... .25
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- Arbor with Two Seats and Garden Gate, 9..... .25
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I Became a Head-Hunter

(Continued from page 83)

gan to throb out of our clearing. The *antos* (devils) would have to be cleared out before the great ceremony could take place.

At ten o'clock a Dyak head-hunter came for Maanyan and me. As the three of us approached the head house I noticed that the heads had been removed from the poles. We climbed the ladder and the Dyak swept back a curtain of long yellow grass. Hesitatingly I entered. The large room was crowded with warriors in long orderly rows of shining copper.

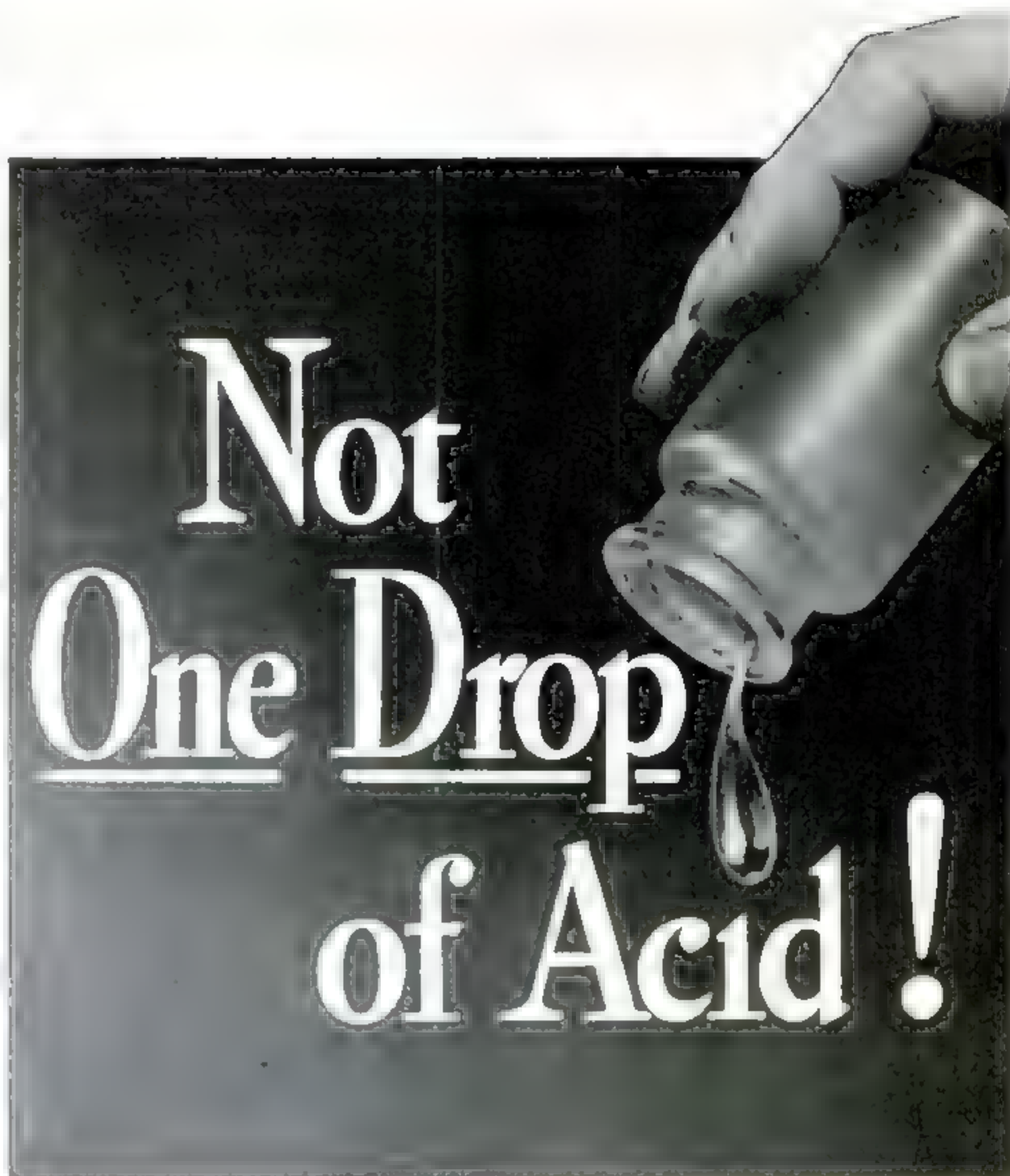
TWO *blians* (witch-doctors) were beating lizard-skin drums and clanking bones, thus chasing devils which might have followed the warrior, Maanyan, and me into the ceremonial house. The *blians* leaped up and down in front of me. I saw the *kapala's* head turn in our direction. He sat proudly in the midst of his finest warriors—the greatest head-hunters in Borneo. The chief raised a horny hand in salute, and in a moment I sat on a mat beside him.

The long lines of warriors began moving in slow, grim, unconscious grace back and forth, back and forth; the minutes dragged out into hours, and I lost all sense of time. All night the warriors swayed—I with them; their tense faces vaguely lighted by torches which, as they burned out, were replaced with others by old men. These men, too old to fight in defense of the tribe, took no other part in the ceremony.

On through the night we swayed—back and forth. The acid tang of sweating men bit my nostrils. Toward morning, the men seemed to become more tense. Above the *kapala's* head and mine hung the five boars' heads. When I moved to prevent the blood from dripping on me, the *kapala* indicated that I was doing decidedly the wrong thing! This was his party; I moved back into the seat of honor, losing little time doing so.

TOWARD morning we began to hear the deep, coughing roar of tigers fighting and feeding on the boars out in the jungle. After an eternity, or an instant, a long blade of yellowish-red light fell through a crack in the bamboo-and-leaf wall. Dawn had come at last. As if they were intoxicated, the warriors trooped out of the head house laughing and talking excitedly. As I left the place, I too felt rested and exhilarated by my unique experience during the night's vigil.

Outside the head house, the *kapala* told Maanyan that I was now a full-fledged head-hunter, and, as such, welcome to the warriors I needed to replace sick Malays in my column for the journey through the bush back to civilization. Also, he hoped that I wouldn't forget to inform the Dutch Government that the ancient head-hunting ceremony was, as now practiced, harmful to no one!



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TIGHT anchoring in concrete or tile—one of your worst puzzles—is easy with Smooth-On No. 1.

For light service, as in attaching bathroom fixtures (Fig. 1), hooks, etc., drill slightly oversize holes, fill with a soft putty of Smooth-On No. 1, set screws in this soft cement and turn up tight.

To anchor a railing post (Fig. 2), make a hole large enough to insert end of post, and tamp the space surrounding the end of post full of Smooth-On No. 1.

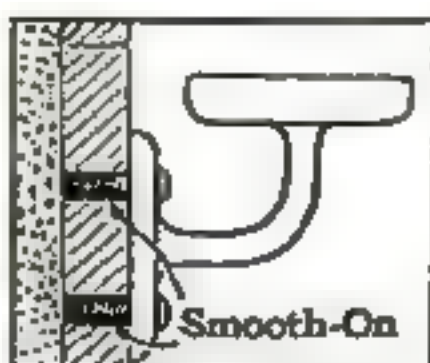
To anchor bolts in a concrete wall, make the hole large enough to clear the bolt head and of proper depth. Insert the bolt head and fill around bolt with Smooth-On No. 1. Large bolts can be set in Smooth-On No. 7. Tamping the cement into place gives a tighter hold. When the cement is hard, the bolt is ready for service.

Lag screws are held by making the hole just large enough in diameter to clear the screw. Put a soft putty of Smooth-On No. 1 into the hole, insert lag screw and turn it up into place.

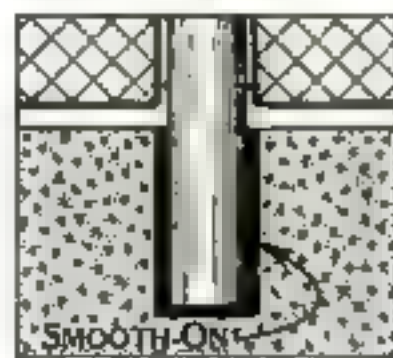
In all of the above applications, the slight expansion of Smooth-On No. 1 in hardening gives a very strong hold of bolt, screw or post.

Use Smooth-On No. 1 in the home also for tightening loose parts and stopping leakage of water, steam or gas.

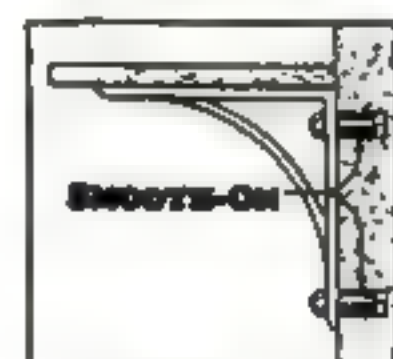
Doing this work in accordance with instructions and diagrams in the Smooth-On



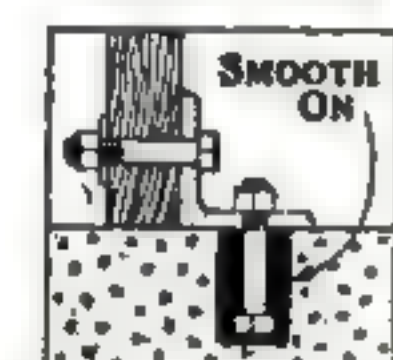
1. Fixtures set in tile or masonry



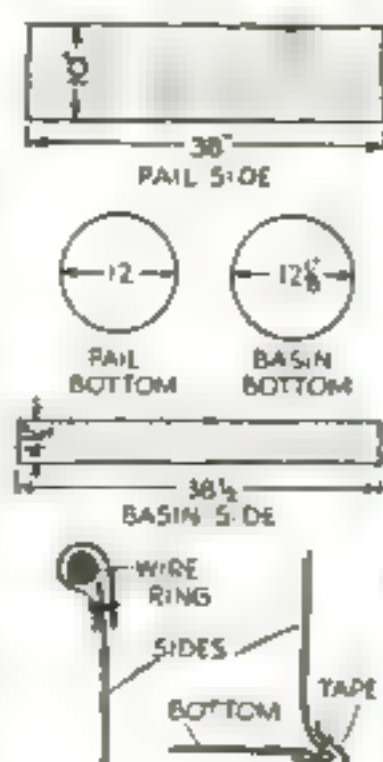
2. Railing post



3. Shelf bracket



4. Wood partition



Canvas Pail and Basin Hold Cooking Outfit

FOR years campers have packed their nested cooking utensil kits in a canvas bag and carried water pails and wash basins made of waterproof cloth. Recently I discovered that the utensil bag could be made to serve also as pail and basin, thus eliminating two separate articles.

Dimensions are given for a bag and cover to hold the average four-man cooking kit. Use factory-waterproofed 10-oz. brown canvas purchased from a tent dealer. After the top edge of pail and basin are bound with 1-in. tape, pierce a small hole in the tape and push in a piece of steel wire so it forms a hoop; then sew the wire entrance shut.

The pail handle, which may be either leather or folded canvas, can be riveted or sewed on. Rivet a $\frac{3}{4}$ -in. buckle to one strap and, if canvas is used, have a shoe-repair shop place sufficient eyelets in the other so the strap can be buckled snug over the cooking utensils or loosened to make a convenient pail handle. Loops of tape are sewed at the top of the pail to hold the handle when water is carried. There are also loops on the edge of the basin to hold it firmly over the top of the utensil kit as shown.

If the seams leak a little, paint them with tent waterproofing or melted paraffin.—MAURICE H. DECKER.

Rubber Cement Fastens Shaving-Brush Hairs



SHAVING brushes that suffer from falling hair may be treated by injecting a good grade of rubber cement. A soda straw, used as a pipette, is half filled with the rubber solution, which is gently blown into the area just above the base of the brush where it binds the bristles.

Making Butterfly Trays

(Continued from page 67)

be held in place with fine pins or with strips of paper held down with thumb tacks. For variety, you might leave a few butterflies with their wings folded. Avoid touching the wings with your fingers; use tweezers or pins.

After drying for a few days, the butterflies are removed from the boards and stored in a flat box until you are ready to make the tray. Keep plenty of naphthalene flakes in the box to discourage moths.

The frames are made by ordinary picture-frame methods. A simple cross section is suggested in the drawing, but this can be modified to suit the taste and ability of the maker. Note that the rabbet is quite deep to allow for the thickness of the glass, cotton, and board backing. A good size is 12 by 18 in. (glass size). Use double-strength glass, fastened securely with brads or glaziers' points.

CUT a back of $\frac{1}{4}$ -in. plywood or very stiff, heavy corrugated cardboard. Lay the back on the bench and spread over it a $\frac{1}{4}$ -in. or thicker layer of quilting cotton. If moths with large bodies are used, it is well to place an extra thickness of corrugated cardboard under the cotton and cut out spaces for the bodies. Spread naphthalene flakes freely between the layers of cotton, and if you wish, a few on top.

Since insects can do much damage to the butterflies in the tray, it is well not to make it up until there has been time enough for all eggs on or in the butterflies or grass to hatch and the larvae to be killed. The cyanide jar should kill most live parasites, and naphthalene flakes in the storage box will get the rest. However, the flakes between the layers of cotton are added insurance.

Two or three days before making up your tray, the box of butterflies should be put in an air-tight container with a pan of water. The moisture will soften them so they can be arranged easily.

Arrange a border of dried grasses along the lower edge and sides. Milkweed silk scattered over the cotton gives a pleasing effect. Grass loses its color as it dries, but you may be able to get dyed grasses from your florist, or you can dye your own. Arrange the butterflies in a balanced and natural composition. From five to ten should be enough, depending on their size.

When the arrangement is complete, set the frame and glass over it, turn the whole over, and tack the bottom in place. Cover the bottom with a layer of paper glued along the edges, and over this a layer of felt.

The tray is now complete with the exception of the handles. These can be bought ready-made or bent from copper or brass rod, $\frac{3}{16}$ or $\frac{1}{4}$ in. in diameter. If brass is used, it may be necessary to anneal the ends once or twice in order to flatten the ends without splitting them. A 7- or 8-in. length will be found about right.



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For Target & Small Game. Economical. Accurate. Practical. Adjustable Force. Amazing. Maximum Velocity. Safe. Single Shot. With Bolt Action. Hammer Fire. Hair Trigger. Safety. Load 177 or 22 or BB or .177. No. 177 and 22 Single Shot Air Rifle \$4.95. No. 177 and 22 Single Shot Air Rifle \$5.95. No. 177 and 22 Single Shot Air Rifle \$6.95. No. 177 and 22 Single Shot Air Rifle \$7.95. No. 177 and 22 Single Shot Air Rifle \$8.95. No. 177 and 22 Single Shot Air Rifle \$9.95. No. 177 and 22 Single Shot Air Rifle \$10.95. No. 177 and 22 Single Shot Air Rifle \$11.95. No. 177 and 22 Single Shot Air Rifle \$12.95. No. 177 and 22 Single Shot Air Rifle \$13.95. No. 177 and 22 Single Shot Air Rifle \$14.95. No. 177 and 22 Single Shot Air Rifle \$15.95. No. 177 and 22 Single Shot Air Rifle \$16.95. No. 177 and 22 Single Shot Air Rifle \$17.95. No. 177 and 22 Single Shot Air Rifle \$18.95. No. 177 and 22 Single Shot Air Rifle \$19.95. No. 177 and 22 Single Shot Air Rifle \$20.95. 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A Loading Platform for Model Railway

WHEN you have put in a siding at some convenient spot along the main line of your model railway, you can build this loading platform as a starter for a small town. Later on you can add a depot made out of an old box-car body, put in a crossing with signs and cattle guards, and erect a small warehouse or stock chute.

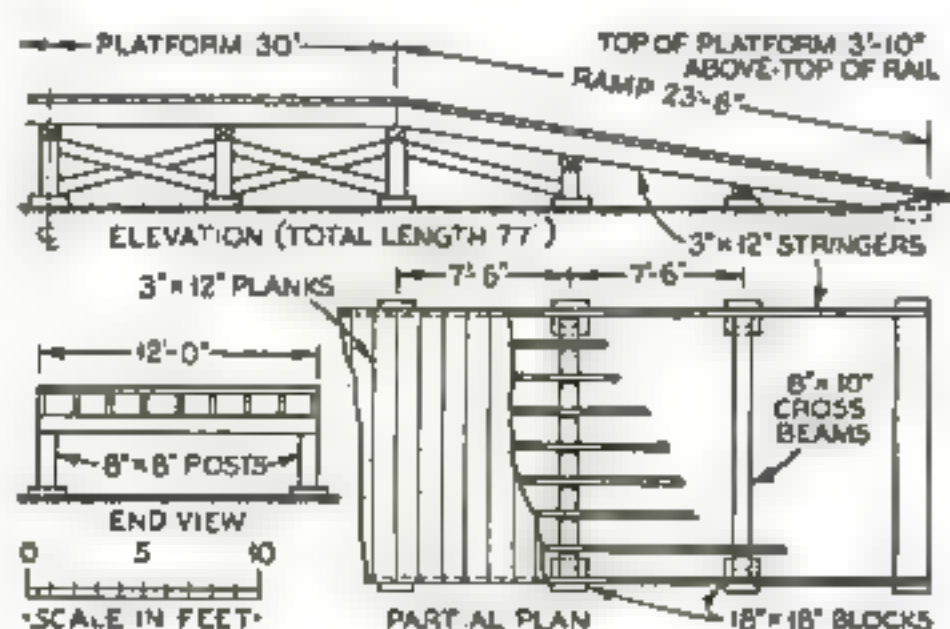
The platform shown in the photograph is built to a scale of 3.5 mm. to the foot. (The track gauge is 5/8 in., commonly known as HO gauge.) The construction is simple because balsawood strips, cut or sanded to the correct size, are used.

If you are building to one of the other small scales, lay out the plan on a piece of cardboard, marking the exact location of each foundation block. The cardboard is used as a temporary working base only. Fasten the foundation blocks to it with thin flour-and-water paste so that the platform can be easily removed when it is finished.

After the foundation blocks are in place, glue the 8 by 8-in. (scaled down) posts to each. The 8 by 10-in. cross beams that support the stringers are then put in place, and then the diagonal bracing is added. The sketch shows nine 3 by 12-in. stringers supporting the planking, but if this seems like too much work, a single piece of wood the same thickness as the height of the stringers could be used. The planking can be represented by lines drawn across the top, but the platform will look more realistic if each plank is cut and glued in place with waterproof glue.

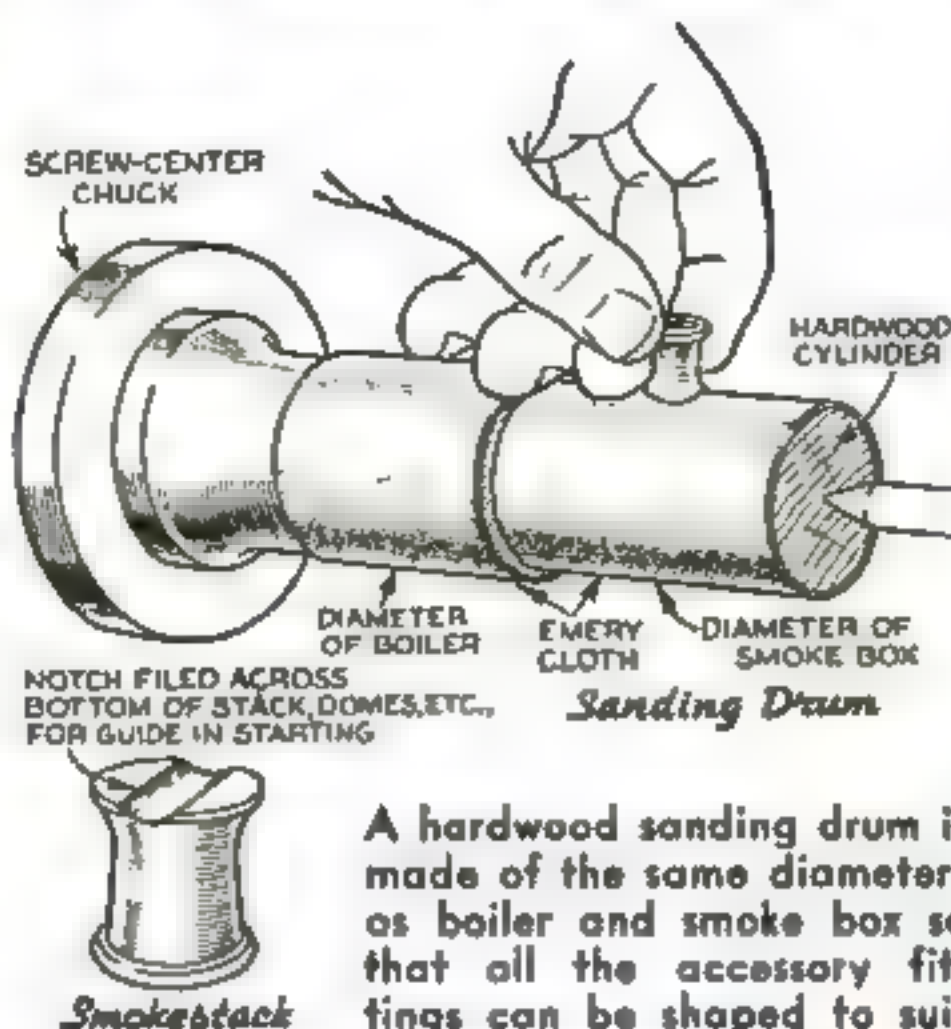
Stain the platform a weathered gray with a few drops of ink in about a quarter of a glass of water.

Use fine clay or sand sprinkled over wet paint for the road leading up to and around the platform, and plant a few weeds, made from bits of sponge, near the road.—J. W. CLEMENT.



Plans for the platform with scale in feet. The photo at top shows the finished model

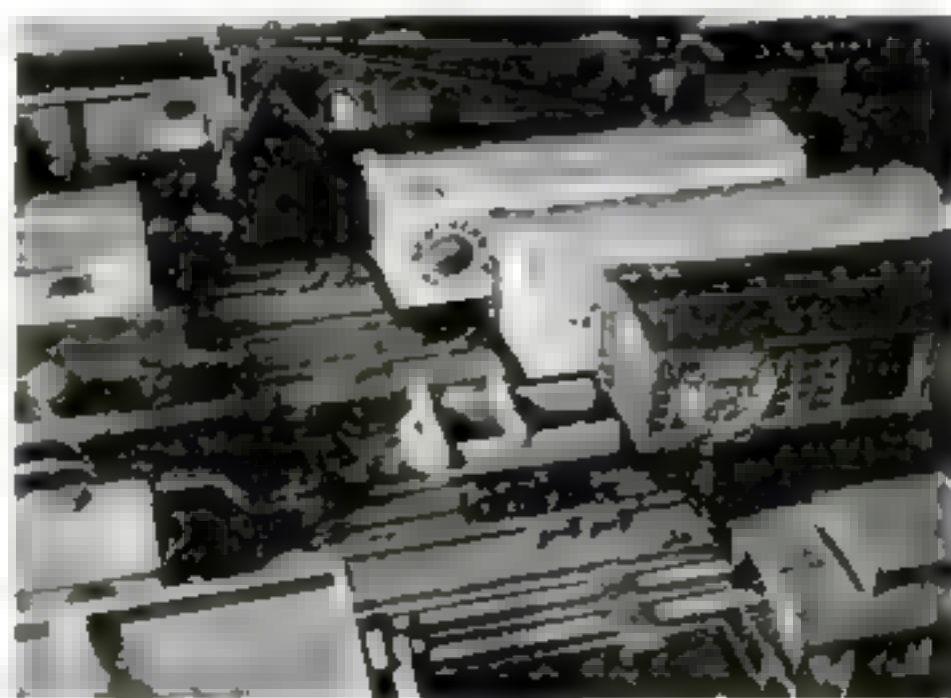
Fitting Parts to Boiler of Model Locomotive



A hardwood sanding drum is made of the same diameters as boiler and smoke box so that all the accessory fittings can be shaped to suit

SMOKESTACKS, domes, saddles, and other parts can be fitted to the exact contour of the boiler on a model locomotive by means of the sanding drum illustrated. A piece of hardwood is turned down to about 3/32 in. less than the boiler diameter, or so that when the emery cloth is glued in place, the drum will be the same diameter as the boiler.

Before applying the work to the drum, the excess stock should be filed away. The lathe should not be run too fast, as the work must be held on the drum with the fingers. Turn the work around frequently, and try it on the boiler occasionally. The finished joint between boiler and fitting should be almost invisible.—ROY S. MACNEILL.



Magnet Used to Drill Model Railway Cars

DRILLING cars is now the only operation that an up-to-date model railroader cannot control from a distant point without doing a lot of walking. This problem may be solved, however, by using a strong horseshoe magnet mounted on an old car truck. Coupled to a locomotive, it will haul two cars of standard gauge. By sharply reversing the locomotive, the cars can be "uncoupled."

After cars have been drilled into their respective tracks, trains of cars may be coupled up by pushing them to a point near the operator.

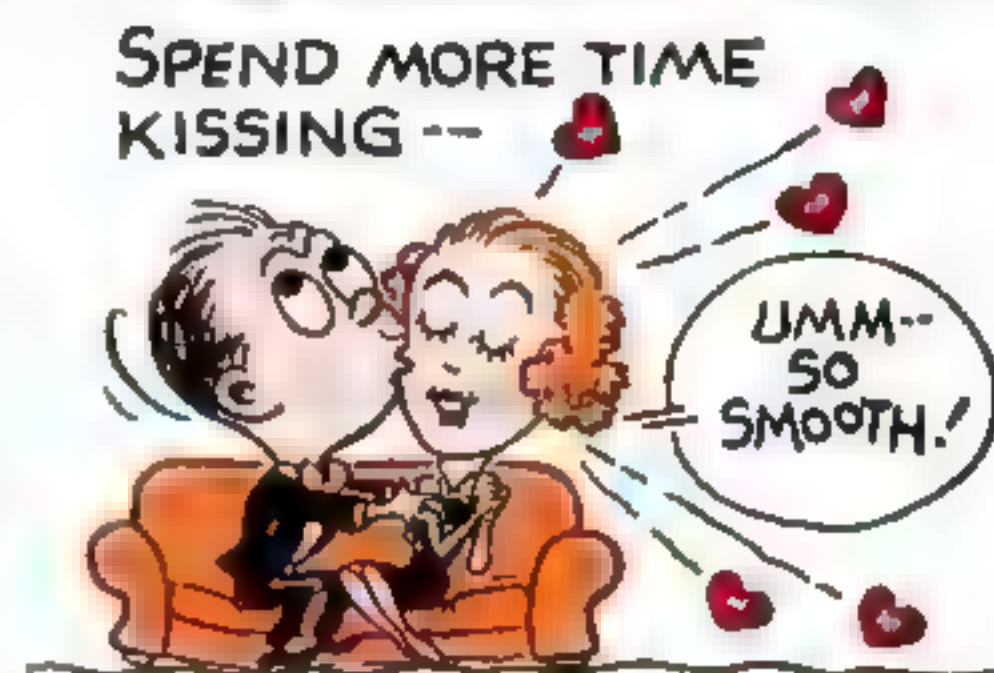
If it is desired to preserve realism, the device could be neatly hidden by incorporating it into the locomotive tender.—WILLIAM FENDRICK.

Treet Topics

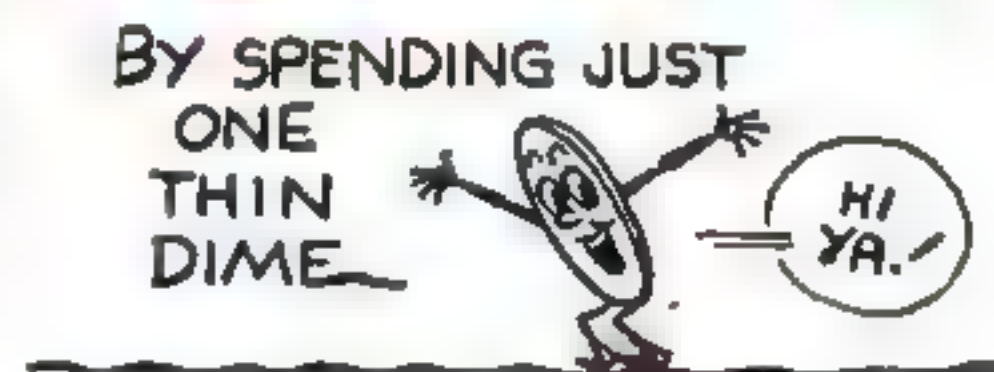
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SPEND MORE TIME
KISSING--



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Flying a Crashproof Plane

(Continued from page 25)

Slim raised his hands in a gesture of nonchalance. "Suit yourself. Where do you want to go?"

I motioned toward the mountains on the east, and described with my arm a course leading back to a position over the San Fernando valley a dozen miles north of the air terminal—a flight that would keep us in the air perhaps twenty minutes. At this, Slim elaborated briefly on the earlier instructions he had given.

"When you turn, swing the wheel exactly as you drive an automobile. Keep the ship level if you can, but don't worry about stalling, for she will not stall. Move the wheel gently, and you'll find the ship banking and turning in any direction you want."

"WHAT happens," I demanded, "if I pull her up in a stall, or try to loop the loop?"

"Little early for that," was his only comment.

Slowly, almost imperceptibly, I moved the wheel to the right. Down went the right wing, and we turned to the right in a gentle bank. I returned the wheel to neutral, then swung left, holding the ship in a turn until we were headed northeast, a direction change of some 150 degrees.

Slim looked at his watch. "Out four minutes," he said, "and you've steadied down already." He meant that I was no longer waddling like a duck through the sky. I had commenced feeling easier in mind when we reached 2,000 feet, and my confidence was quickly evidenced through the handling of the controls.

During the next few minutes I concentrated on holding an even keel, and enjoying the scenery. Slim and I were sitting side by side in the comfortable cabin, which is placed above and in front of the wing. Through the celluloid windows, visibility ahead, to the side, and below was better than from my automobile. Across the top of a metal member in the open ventilator slot in the nose, I lined up a mountain in the distance, and by observing a distant peak maintained reasonably straight and level flight.

"You asked about stalls," Slim said. "Want to try 'em?"

THIS was a little more than I had bargained for, but I opened the throttle wide, drew the wheel back, and, hanging on grimly, awaited results. The response was instantaneous.

Up went the nose. With a roar, the engine pushed us up until it seemed we were suspended vertically in the sky. Momentarily we hung there, then the nose dropped and as the engine gained speed, we descended briefly in a shallow power dive, and once more the nose rose. Three times we climbed, descended, climbed, the wings remaining fairly level throughout the maneuver. During the third dive I leveled off, throt-

tled back, and looked inquiringly at my instructor.

"Why didn't we fall off on one wing from those stalls?" I demanded.

"She's rigged for balance," Slim explained. "Also, the nose began to drop when you slowed to about eighty. You see, you never lost flying speed."

This seemed reasonable, but I was curious to learn the result of a stall at cruising speed.

NOW, with the engine turning 1,800 revs, I sent her up once more. Except for speed and distance of climb, the stall approximated the earlier attempt. We ascended briefly, at a less steep angle, the nose dropped—and again, after picking up speed, we climbed, stalled, and nosed down.

"Can I loop her?" I asked, after straightening her out.

Slim vetoed this one. "No need to try," he declared, "because the plane doesn't have enough control surfaces for that. Closest you can come to a thrill is a tight vertical turn. You see, you have plenty of speed in a turn to control the ship easily."

By this time, I had regained my confidence completely. No doubts troubled me until we had passed the airport on our northward leg and Slim suggested we prepare to land.

"You keep it," he said, when I started to pass the wheel back to him. "Swing about, locate the airport, go down to 1,000 feet about a mile from the runway, and aim for the landing strip."

It sounded simple, the way Slim said it. Head for the ground and fly in!

I swung left and soon located the air terminal over Slim's shoulder through the left cabin door. Continuing the turn, I started off in an easterly direction until the landing strip appeared off to my right. A right turn, and I could see the field about six miles ahead, a little west of south.

"Cut the motor to 1,800," Slim advised, calling my attention to the tachometer, which showed 1,850 revs. "You'll cruise better."

WE SAILED on a couple of miles, when Slim motioned down. The wheel went forward, and we descended until the altimeter registered 1,000 feet. Meanwhile Slim explained why any amateur on his first flight may dare to land this velocipedelike plane without help from the instructor.

"Remember," he emphasized, "we have three wheels. That means we can't nose over. Also, the two rear wheels are eight feet apart. That means we can't ground-loop and smash a wing. Each wheel will recede eighteen inches into its recoil mechanism—so, no matter how hard you hit, the ship will not bounce.

"Here's another thing." He touched a lever resembling an automobile emer-

(Continued on page 95)

Anyone Can Fly This Crashproof Plane

(Continued from page 94)

gency brake, extending upward from the floor alongside the control column. "Pull the lever and you set the air brakes. With the flaps down, you'll land at fifty or less."

I set the air brakes.

When I figured we were a mile from the runway, I looked to Slim once more for instructions. "Throttle the motor back," he continued. The roar of power subsided to a rhythmic ticking.

"HOLD air speed at eighty," Slim went on. As I pushed the wheel forward to keep the nose down, I quickly consulted the air-speed meter. The needle settled back from 120, where we had been cruising, to seventy. A little more forward wheel, and it climbed to eighty. Through the forward windows I could see the near edge of the runway dead ahead.

The last mile down the invisible chute fled past too quickly to leave more than fleeting impressions. Houses. Power line. Here comes the ground. Less than 100 feet ahead is the runway.

"Level off when you're twenty-five feet from the landing strip," Slim said, unhurriedly.

As he spoke, I eased back on the wheel. Down came the twin tails. The wheels touched, their shafts receding into the sockets as 2,500 pounds of plane and crew settled to earth. Slim jammed down the foot brake, and we pulled up to a quick stop.

I turned to my instructor with a question. "When did we land?"

"Eighteen inches before you expected to touch concrete," he declared. When I thought I was leveling off, I was already on the ground, having hit at forty-five miles an hour.

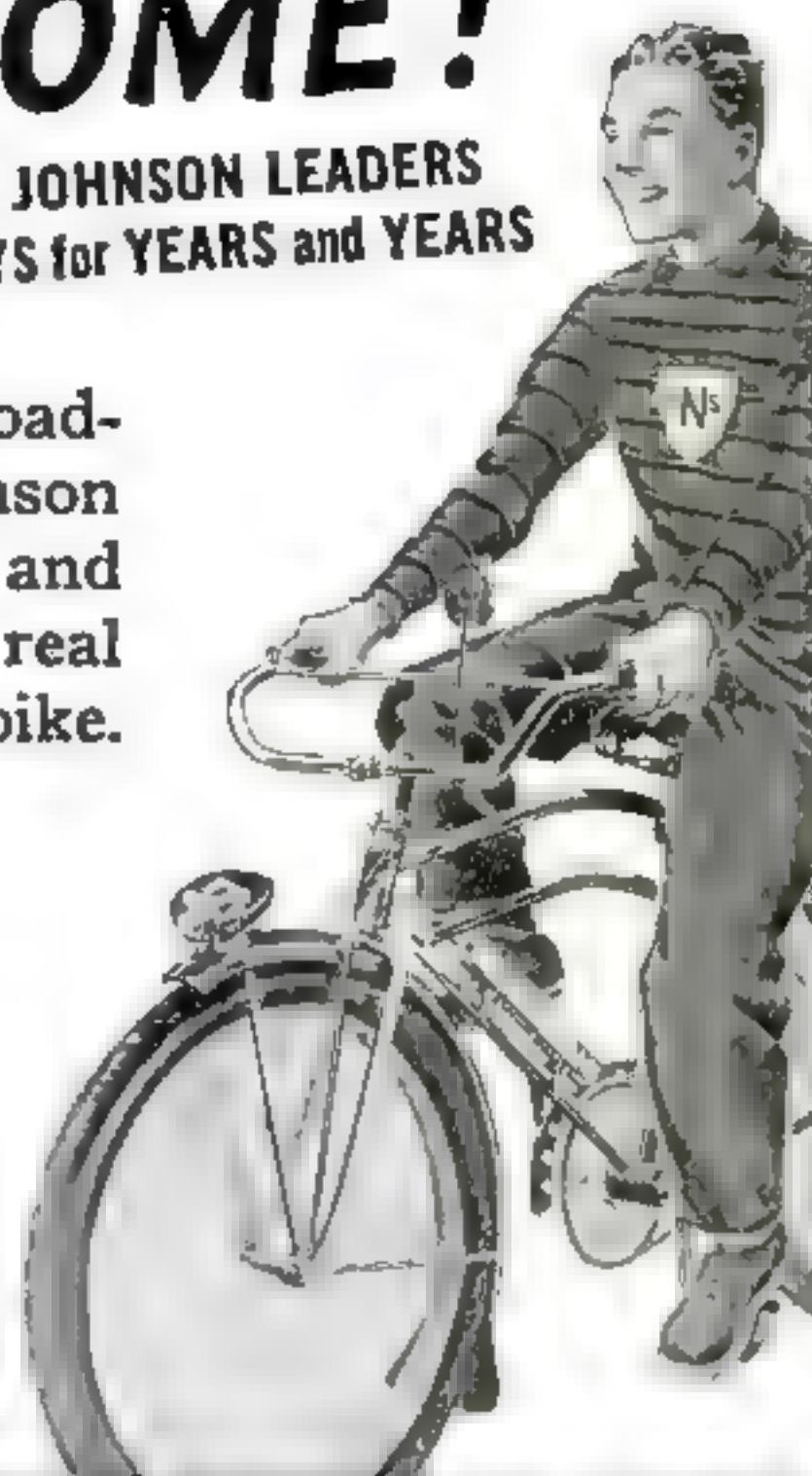
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Filters Help Your Microscope

(Continued from page 73)



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creased when the filter absorbs the light that the object transmits. And it goes without saying that, when the filter transmits the light that the object transmits, contrast is reduced. Usually there is a happy medium between these extremes that produces best results.

The easiest way of determining just what filter to use to make a certain colored object, such as an insect leg or a piece of stained tissue, appear at its best, is simply to look at it by light of different colors. Here is a table that will help you select filters when you want to produce maximum contrasts:

COLOR OF OBJECT	FILTER TO USE
Violet	Yellow
Purple or Red	Green
Blue or Green	Red
Yellow or Brown	Blue

As an example, the horny legs and various other parts of insects are yellowish in color. If you employ a violet filter with them, maximum contrast will be produced. That is, the leg will appear black against a blue background. Usually, however, because of the thickness of the specimen, such contrast increase will blot out details. So it is desirable in such cases to reduce contrast rather than increase it. Remembering that maximum detail is seen when the object is examined by light of a color that it transmits, you find that a yellow or a red filter produces best results.

IN GENERAL, the effects obtained in making photomicrographs with panchromatic (all-color-sensitive) plates or films used in conjunction with filters are practically the same as the visual effects.

Filters employed in microscopy are almost invariably placed between the light source and the microscope. Professional-type microscopes have slots below the substage condenser and diaphragm to receive disk-shaped filters, 33 mm. in diameter.

(Continued on page 97)

There are various kinds of filters that the amateur microscopist can use to improve the performance of his lenses. These include colored glass, colored gelatin of the kind used in lighting window displays, cellulose acetate film, colored liquids, and colored gelatin specially designed for filter work. In fact, almost any colored material that is transparent enough to transmit sufficient light can be used.

IN LARGE laboratories, scientifically made filters are invariably used for both visual work and photomicrography. These provide accurate control of wave length of light transmitted and absorbed. In the United States, probably the filters most commonly employed are those known as the Wratten "M" series. Fortunately, they are not beyond the reach of the amateur, for they can be purchased in the form of stained-gelatin sheets for something like ten cents a square inch. A convenient size is 2 by 2 in. The colors are designated by numbers. A complete set of visual filters would include the following: No. 78, blue, for general use to convert incandescent-lamp light into daylight-quality illumination, which reduces eye strain; No. 38A, blue, to increase contrast of faintly colored yellow objects; No. 45A, blue-green, to enable maximum detail to be seen, as in study of diatoms; No. 66, light green, to increase contrast of red and pink objects; No. 58, green, to increase contrast of very light pink and red objects; No. 15, yellow, and No. 22, orange, to increase contrast of blue objects and improve detail of insect preparations; No. 25, red, to increase contrast of blue objects such as those stained with methylene blue; No. 96, a neutral-density filter for reducing brightness of light without changing color, transmitting about ten percent of the light striking it.

IF YOU intend to use filters in the form of thin sheets of gelatin, cellulose film, or the like, mount them between glass for protection. It is not necessary to use optically perfect glass, because the filter is placed between the light source and the microscope, and does not interfere with the microscope's optical system. Clear glass obtained by washing the emulsion from photographic plates or lantern slides is excellent. At photographic stores, you can purchase 2 by 2-in. squares of thin, flawless glass originally intended for use as cover glasses for photographic transparencies to be projected on a screen. Handle filter gelatin with tweezers, and do not touch it with your fingers, or you will leave smudge marks. Place the gelatin sheet between two pieces of clean glass, and bind the edges with lantern-slide tape, either the gummed-paper type or that made by coating cellulose film with rubber cement. Perhaps some of the metal

Filters Help Your Microscope

(Continued from page 96)

frames recently introduced for holding small photographic transparencies between the glass squares can be used instead of tape.

Liquid filters consist of colored solutions in water, held in bottles having flat, parallel sides, or in spherical flasks which act also as condensing lenses to concentrate light on the microscope mirror or the object. You can arrange a simple holder for such a flask. The main thing is to elevate the flask above the table sufficiently to align it with the microscope mirror and light source.

A COMMON use for a liquid filter such as a flask of colored water is to convert artificial light into daylight-quality illumination and thus reduce eye strain. Solutions of copper salts, which are blue, are usually employed for this. Other liquid filters include: potassium bichromate, saturated, to produce yellow; saturated copper sulphate one part, saturated potassium bichromate three parts, and a few drops of sulphuric acid, green; aniline red or neutral red, one part to about 1,000 parts and diluted as required for thick vessels; chrysoidine, same dilution, producing orange filter.

Strikingly beautiful effects can be obtained by employing differential color illumination. A microscope having

a substage condenser is essential. If your instrument is not so equipped, try inserting a short-focus plano-convex lens, such as those some times employed on the end of cheap flash lights, beneath the stage, flat side up.

TO OBTAIN differential color illumination, insert beneath the condenser a ring of colored gelatin having in its center a circular hole whose diameter is about one half the total diameter of the ring. The ring, say, is red in color. Now, with the condenser focused on the object and the iris diaphragm wide open, you will see a red-lighted object against a white background (assuming that the source of light is white). Next, insert a small disk of different-colored material to cover the center hole in the red ring completely, and the color of the background changes to that of the smaller disk. Remove the ring, and you see a white object against a background the color of the small disk. Contrasting colors such as blue and yellow are generally best. Magnification should not be too great, a 16-mm. objective being about the most powerful usually employed. If you cut your own differential rings and disks from colored celluloid or other material, make the rings about 33 mm. outside diameter, and the center hole 16 mm.

Rear Ends Aren't Foolproof

(Continued from page 54)

"Sounds like a burned-out bearing," said Joe Clark.

"It does sound something like that—but I've never heard a noise exactly like that one before," Gus said, looking a little puzzled. "Speed her up again, Harry." He opened the hood, and stood listening with his head cocked to one side. Suddenly he reached in, and jerked something from under the hood. The grinding noise stopped—and didn't start again.

GUS turned to Mrs. Miller. "Well, it wasn't the differential," he assured her. "Or anything else serious." He held out his big hand and showed her a disk of heavy cardboard. "When they changed your oil," he told her, "they tied this card on to the radiator brace near where it is fastened to the dash—the way they always do to remind you when you should have your oil changed again. See how the card is twisted—into something like the shape of a propeller blade? Well, when you were driving slowly nothing happened. But when you speeded up, the stream of air from the fan became strong enough to start the card revolving, and as it whizzed around its edges rasped against the dash, making the noise that made you think that your engine was coming apart. Not a bit of harm done."

Mrs. Miller drove off gushing thanks.

Gus looked after her, smiling. "She's not a bad sort of woman," he said, "even if she is the world's silliest talker and worst driver. Funny thing about noises in a car," he went on reminiscently. "I remember once when I was—"

From outside the open doors came a high-pitched grinding shriek that set the three men's teeth on edge. "Here's someone who is in real trouble, and no fooling!" Gus said as they started out.

A big and plutocratic-looking roadster had stopped in the driveway, and a big and equally plutocratic-looking gray-haired gentle-man was getting out of it.

HE GAVE the three of them a quick glance, and then addressed Gus. "You're Gus Wilson, of course," he said. "My name is Brown—Z. Jonas Brown; lawyer in the city—maybe you've heard of me. Well, down at the hotel they told me that you are a man who knows his business inside out. Did you hear that confounded noise when I drove up?"

"I heard it," Gus said.

"I've been listening to it for sixty miles," Z. Jonas Brown said grimly. "And I've had enough of it! I haven't been doing any driving for the past several years—too busy; wouldn't be driving now except that my chauffeur got

(Continued on page 98)

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Rear Ends Aren't Foolproof

(Continued from page 97)

sick in Albany. But I used to know something about cars. I'd say that noise means trouble in the rear end—only they tell me that rear ends don't break down any more. What do you say?"

"Judging by what my ears tell me," Gus said, "my guess would be the same as yours. But a long time ago I learned not to believe what my ears tell me until I've checked up with my eyes. Want me to take a look?"

THE big man nodded. "Put her on the lift and raise her up, and get the rear-end cover off," Gus told Harry. After they had emptied the rear end of grease, and flushed it thoroughly, Gus made a careful examination of the gears. When he finished, he looked at Brown, and slowly shook his head from side to side.

"Well, what is it?" demanded the lawyer. "Gear tooth broken?"

"No, nothing is broken," Gus said. "But your gears are badly galled."

"That's a new one on me," Brown admitted. "What the devil are galled gears?"

"Look for yourself," Gus invited. The car owner put on a pair of rubber-tired spectacles and peered intently into the gear case. "Notice how highly polished those gears are?" Gus said. "And see how the polish has been worn off them in places? Well, that's what galled gears are."

"But why," asked Brown, "are they galled? What's the cause?"

"The wrong grease, directly," Gus told him. "Indirectly, your chauffeur's trustful nature—or maybe his carelessness. He has had the car lubricated at some service station, and he didn't check up to make certain that they used the grease recommended by the manufacturer—grease of the proper viscosity. There aren't any two greases in the world that will mix properly in a car's rear end."

"Humph!" grunted the lawyer, and Gus had an idea that the chauffeur was going to be in for a torrid ten minutes. "All right, Mr. Wilson. Get the trouble fixed up, so that I can be on my way within an hour. I've got work to do to-night."

"GALLED gears," Gus said, "are one of the things that can't be fixed up. I can adjust them so that they won't be quite so noisy, but not so that they won't bother you. New gears are what you need, Mr. Brown—nothing else will do any real good. They'll cost you something over fifty dollars, but they'll save you a lot of wear and tear on your nerves."

"Put them in!" snapped Brown impatiently.

Gus shook his head regretfully. "I'd like to do the job for you, but I'd have to get the gears from the city, and you couldn't have your car until some time tomorrow afternoon. I'll adjust—"

"You'll adjust nothing!" growled

Brown. "You found the trouble, so you fix it! Get the gears and put them in, and I'll send my chauffeur for the car as soon as he gets over his cold and comes back to work. And don't forget to tell him a few things about watching his lubrication. Run me down to the railroad station, will you?"

AFTER he had ridden off with Joe Clark, Gus looked at the gleaming roadster, and shook his head almost sadly. "It's money in our pocket, of course," he said to his assistant, "but I hate to see a swell job like that one given that sort of treatment!"

"It ain't right," Harry agreed. "But what was it that the old bird said about rear ends never breaking down any more?"

"It came close to being the truth," Gus said. "How many rear-end jobs have you worked on since you've been here?"

Harry thought back. "Not so many," he admitted. "There was George Nelson's coupe, and the Bronsons' bus—that's all that I remember."

"Nelson's coupe is a '31 model, and the Bronsons' car a '33," Gus said. "That's the answer, Harry—any model before 1934 was liable to have rear-end trouble, but you don't run into it much in the later models. And when you do run into it, it's nearly always the result of the owner using improper lubrication."

"When a car comes in making a sort of growling noise, it's a pretty sure sign that it has a tooth broken out of one of its gears—usually caused by the breaking of a spacer that separates the balls in a bearing. When there's a sort of click every time the wheels turn, it's usually a broken tooth in one of the spider gears that allow play in the wheels in turning. Sometimes you'll get a whistle at high speeds, and no noise at all at low speed—that's usually an inefficient adjustment lock that needs to be either tightened or loosened to obtain the proper adjustment."

BUT, remember, no matter what sort of rear-end trouble results, its cause nearly always is improper lubrication. That's especially true of the cars of recent models. Car owners would save themselves a lot of grief if they'd always have their lubricating done where they know it will be done right. I want them to know that it will be done right at the Model Garage—that's why I'm so fussy about finding out just what lubricant the manufacturer recommends for every car that comes in here. Almost any car on the road these days needs at least three different kinds of lubricants. Some service stations haven't got them all—and a few service stations that haven't got them all use something else. And using the wrong lubricant means certain trouble—even in these days when rear ends don't break down any more!"



Double Box Speeds up Photo Printing

WHEN a number of prints have to be made from the same negative and it is not desirable to develop them one at a time, a double box like that illustrated is an aid in handling the paper rapidly. The unexposed paper is taken from the lower section, exposed, and placed in the upper section until the worker is ready to develop it.

The two box sections and the lid are fitted with spring hinges so that the box cannot be left open. This eliminates the possibility of fogging any paper if a white light is inadvertently turned on.

The box shown is 9 by 11 in. inside to take 8 by 10 in. paper. For contact printing from small negatives, partitions may be used in both sections to keep the various grades of paper separated.—JOHN NICHOLS.



Using Baby Flash Bulbs in a Large Reflector

IF THE new baby flash bulbs are used with large reflectors designed for standard size photoflash lamps, a "hot spot" of light will be deflected upward, and both reflector and bulb will be much reduced in efficiency. All that is necessary, however, to raise the midjet bulb opposite the center is to insert an ordinary screw-in plug in the socket and then plug into this a socket adapter, into which the flash lamp itself is screwed.—M.S.



Photographer's Alcohol Kept Free of Water

A BAG made of three or four thicknesses of muslin and filled with potassium carbonate may be used to free alcohol from the water it absorbs after photographic films have been dipped in the alcohol to hasten drying. The bag is hung from the cap of the bottle as shown. The chemical may be used repeatedly by drying the bag in the oven each time it becomes saturated with water from the bottle.



Alcohol bottle with bag tied to the cap



Wax-Paper Sheets Used on Photo Scales

CLEANLINESS and accuracy in weighing photographic chemicals can be assured by using a sheet of wax paper on each pan. Cut a supply of sheets, all exactly alike in size, and hang them with a thumb tack through one corner so that one piece at a time can be pulled loose.—K.M.

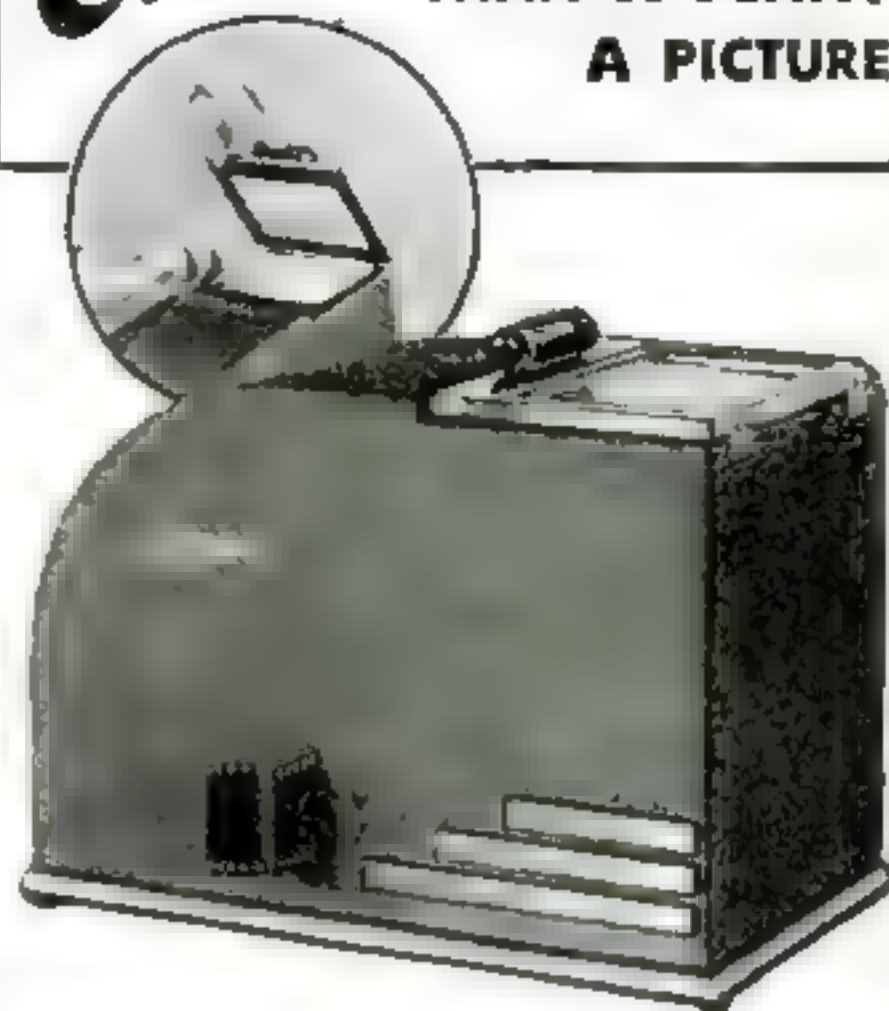
Spring Guard Protects Cord of an Enlarger

A SPRING wire guard from a worn-out electric iron or toaster plug may be used to protect the electric cord leading from the lamp house of a homemade photographic enlarger. The guard can be attached by screwing it over a short pipe nipple set into the threaded hole of the socket. You can purchase these guards from most electrical dealers.



Upper part of homemade enlarger with a guard to protect the cord

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Hints on Photographing Aerial Fireworks

FIREWORKS displays can be captured by the amateur photographer even if he has nothing better than a box camera. Always use a tripod or fix your camera on a firm support so that it will not be jarred when you open and close the shutter. You should, of course, be able to move the camera if necessary so that the aerial bursts can be properly centered. A lens sunshade is a desirable accessory if available.

With a lens slower than F/6.3, it is best to use the largest diaphragm opening. As long as the camera is not moved, you may leave the shutter open until you have photographed several aerial explosions on the same film. If you have a camera with a fast lens, exposing at F/4.5 for 1/25 second will get the picture. An instantaneous snapshot should be made, however, only when it is impossible to steady the camera for a time exposure.

If you do your own darkroom work, develop fully and print on contrasty paper. Overexpose in printing to get a jet-black background for the fireworks display.—ISRAEL HOLTZMAN.

Sharp Edges of Shelves Padded with Rubber

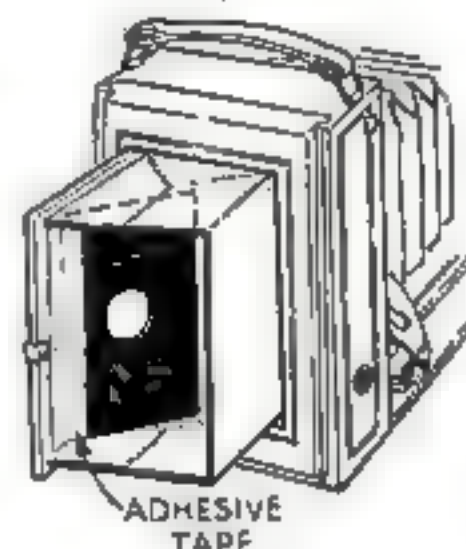
IF THERE is a cabinet or shelf in your shop on which you are likely to bump your head occasionally, nail or cement a piece of sponge rubber around the edge of the wood. In the case of a shelf, overlap the rubber about ½ in. on the top and the bottom, or on the bottom only of a cabinet. The overlap on the shelf will prevent articles from slipping off. The rubber may be painted, if desired.—ROBERT MILLER.

Copper Shield Camouflages Ordinary Flowerpot

FOR an exceptionally decorative flower pot shield or cover, scallop a piece of sheet copper approximately 6 by 18 in. across the top with tin shears and bend it into a circle with edges overlapping. This shield can be used on a succession of ordinary clay pots as the flowers or bulbs come into bloom. The overlapping edges enable it to be adjusted to almost any size flowerpot and its drainage saucer.—H. PAPASHVILY.

Cardboard Shield Aids in Focusing Camera

IN TAKING outdoor pictures in daylight with a ground-glass focusing camera, or any pictures where there is a bright light behind you, it is often difficult if not impossible to see clearly the image on the glass without using a focusing cloth. To eliminate the need for this, the simple device illustrated may be fitted to your camera in a few minutes and at no cost.



The cardboard shown partly folded down

Cut a rectangle of black cardboard to fit snugly in the rear opening of the focusing hood, and in the center make a hole about 1 in. in diameter. Attach the cardboard shield to the bottom plate of the focusing hood with a hinge of adhesive tape.

To use the device, merely lift it up on its hinge so that it covers the opening of the hood. By putting your eye near the hole, you cut out all light from behind and at the same time can see the whole ground glass. To close the hood, the shield may be folded down out of the way.—K. M. S.



Reflections are eliminated by viewing the ground glass through a hole in the shield

Neon Darkroom Light

A 2-WATT, 110-volt neon lamp, which usually costs forty cents, makes an excellent darkroom light for all types of emulsions except infra-red. It can be used clear for work with contact and chlorobromide papers. A layer of yellow cellulose wrapping material, obtainable at ten-cent stores, may be held on with a rubber band for use with bromide enlarging paper, and a layer of red wrapping material makes it suitable for ordinary orthochromatic film. For work with panchromatic and color film, use two layers each of blue and green cellulose material, but wash the film for one minute in cold running water and then view it only momentarily in the light. This type of light is especially desirable where the heat of ordinary lamps is disagreeable.—W. EDWARDS BROWN.

Do Electric Shocks Really Kill?

(Continued from page 45)

at present. Tests of the kind have never been attempted. The nearest approach was the unsuccessful effort of a New York attorney in 1928 when the notorious murderess, Ruth Snyder, was put to death in the electric chair at Sing Sing Prison, N.Y.

ON THE night of the execution, Joseph V. Lonardo, one of the defense lawyers, served an eleventh-hour writ on Warden Lewis E. Lawes, forbidding an autopsy. His plan was to rush the body to a near-by sanitarium where a physician would be waiting to administer an injection of the gland extract, adrenalin, in an effort to start the heart of the executed woman beating again. Lonardo conceived his daring idea after reading of a Montclair, N.J., man who was brought to life after apparently being dead for several hours.

The scheme was never tried, because Warden Lawes was instructed by his legal advisers to ignore the writ, which was not properly signed by a judge. The customary autopsy was performed and the question of whether victims of the electric chair could be "brought to life" by modern science remains to be settled.

Another question concerning electrocution is also obscure. Does it bring instant unconsciousness, or does the victim suffer intensely before oblivion comes?

Until recently, it was generally accepted that electrocution performed its deadly task efficiently and with a minimum of suffering. But, does it? Although no prisoner has ever emerged from the death chamber to recount his sensations, A. B. Rose, an electrician of Winston-Salem, N.C., not long ago described graphically the agony experienced by a person when high-power electric current surges through his body.

Rose was holding a grounded wire when lightning hit it. As the current struck him, he related afterwards, he thought every bone in his body was breaking. Every tendon seemed to snap. A hundred million red-hot needles were stabbing him. Then he saw a sheet of blue flame and all pain ceased. He was "dead" for fifteen minutes before first-aid treatment revived him.

HALF a century ago, when agitation for the electric chair in place of hanging was at its height, the new departure was hailed as a humane advance. In the long history of capital punishment, death has been inflicted on condemned prisoners in manifold ways. Boiling alive, burning at the stake, crucifying, stoning to death, strangling, garroting, beheading—all have been tried. In 1818, there were 150 different offenses for which people were hanged in England.

The gallows, the guillotine, the electric chair—each in its turn, was con-

sidered a humane and scientific solution of the problem of dispatching the condemned. In 1889, electrocution was called "electric sleep."

Then, on August 6, 1890, the world's first legal electrocution took place at Auburn Prison, N.Y. Through inexperience and poor equipment, the job was bungled. William Kemmler, the condemned man, was literally burned to death. A wave of protest swept across the country. Since then, however, the technique has been refined, and there are few instances of bungling. About four minutes is the average length of time that is required for an electrocution.

THE latest type of chair, recently demonstrated at the Cook County jail, in Chicago, Ill., has eliminated straps and buckles. By pulling small levers, the executioner can fasten the prisoner in place with metal rods and copper strips. The time required for the whole operation is less than five seconds.

At present, twenty-one of the forty-eight states have adopted electrocution as the legal method of putting condemned prisoners to death. Twelve have retained the gallows; one, Utah, gives the prisoner a choice between hanging and shooting; seven have abolished capital punishment; and the remaining seven have substituted a lethal gas chamber for the electric chair.

In such a chamber, the prisoner is strapped to a chair, the door is sealed, and a guard outside pulls a lever. Sixteen "eggs" of cyanide drop into a pan of sulphuric acid under the chair. Fumes, bluish and having an odor like almonds, rise and bring death to the condemned man. In place of hydrocyanic gas, some authorities are advocating carbon monoxide, which is odorless and invisible, on the grounds that it would reduce the mental suffering of the victim to a minimum.

WHETHER gas chambers are more humane than the electric chair is still a question for debate. But there can be no doubt of the fact that a prisoner subjected to fifteen minutes of the fumes is dead beyond the power of resuscitation. The lethal chamber and the electric chair kill in far different ways.

As far back as 1908, Dr. Louise Rabinovitch, of New York City, conducted experiments on electrocuted animals and succeeded in reviving some of them after they appeared to be dead. But only recently have scientists assembled careful, detailed data on the effects of electricity on the human system. As a result of their researches, doubts about the electric chair have been brought to the fore, Penologists and public officials alike are reexamining the claims of electrocution.

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Home Tests with Phosphorus

(Continued from page 75)

would burn up the phosphorus and react with the aluminum as fast as it entered the tube. With the supply turned low, only a small amount of gas will escape into the room in the brief time required for the experiment, and will not be objectionable if you open the top windows to get rid of it.

When you call for a lemon phosphate at the soda fountain, your glass will get a few dashes of liquid from a bottle containing a weak solution of phosphoric acid. Interesting chemical experiments can be performed at home with a strong solution of this compound of phosphorus.

COPPER coins, medals, and small art objects can be cleaned and polished remarkably well by using phosphoric acid in a miniature electroplating bath. The copper coin or other article forms the anode; a solution of phosphoric acid, the electrolyte; and an electrode of copper or of carbon, the cathode. Two dry cells supply the necessary current. This set-up for "electro-cleaning" may be conveniently arranged as follows:

Connect the positive, or center, terminal of one of the dry cells to the negative, or outer, terminal of the other. From the remaining positive terminal, lead a wire to a disk of copper, lying flat at the bottom of a beaker or tumbler to serve as an electrode. Place the coin or other object to be cleaned upon this disk. Fill the vessel with a solution made by diluting "drug-store" or eighty-five-percent phosphoric acid with about three times its own volume of water. Finally, arrange a second copper disk or electrode horizontally in the solution, about half an inch above the copper article to be cleaned, and wire this disk to the unattached negative terminal of the pair of dry cells. This will start the flow of electric current through the bath. In half a minute, the copper object will become clean and highly polished as a result of the electrical action. You can use the liquid, or electrolyte, over and over again. To compensate for the weakening of the dry cells with repeated use, the upper electrode is lowered from time to time, to bring it nearer to the lower one. Collectors of coins, among others, may put this "electro-cleaning" process to good use for cleaning dirt and corrosion off copper coins.

PHOSPHORIC acid is also used to produce a "phosphate coating" on articles of iron or steel before they are painted or enameled. This undercoat of iron phosphate provides a surface to which paint adheres well. Even by itself, it protects objects fairly well against rust, for corrosion penetrates the chemical coating with difficulty. You can try out the process for yourself with a solution made by diluting about an ounce of strong phosphoric acid (such as the eighty-five-percent

solution) with a quart of water.

Boil the iron or steel objects in this solution. While it is boiling, add about one fifth of a teaspoonful of manganese dioxide. The acid reacts with the iron and forms the surface coating of iron phosphate, liberating hydrogen gas in the process. The manganese dioxide helps matters along by oxidizing the hydrogen, removing it as fast as it forms. After half an hour or so in the hot bath, the metal objects should be removed, washed well, and dried in a warm place for several hours.

SODIUM hypophosphite, a compound readily obtainable from dealers in chemicals, offers another source of phosphorous compounds for your experiments. Try heating about a teaspoonful of it in a test tube fitted with a one-hole cork and a short length of glass tubing. The chemical decomposes. Instead of yielding free phosphorus, as sodium phosphate did in the "cold-flame" experiment, it liberates a gaseous compound of phosphorus and hydrogen, called phosphine. When this gas issues from the end of the outlet tubing, it spontaneously catches fire in the air. Don't put your finger in this soft, greenish-yellow phosphine flame; the charred remains of a scrap of paper thrust into it will show that this would be a rash experiment, for the flame has plenty of heat to burn.

Only the presence of an impurity makes phosphine take fire of its own accord. To prove this, repeat the experiment in such a way that the escaping phosphine gas must pass through a chilled condensing vessel before meeting the air. This time, when you heat the sodium hypophosphite, the phosphine that issues from the outlet of the apparatus will not ignite spontaneously. It is another compound of phosphorus.

(Continued on page 103)

POPULAR SCIENCE Question Bee

ANSWERS to the Question Bee on page 50 are listed according to numbers, below. Give yourself four points for each question answered correctly. A score of 92 or better is excellent, and from 80 to 88 is a good average.

QUESTIONS

- | | | | | |
|------|-------|-------|-------|-------|
| 1. c | 6. b | 11. a | 16. b | 21. c |
| 2. b | 7. b | 12. c | 17. c | 22. d |
| 3. c | 8. d | 13. c | 18. b | 23. b |
| 4. c | 9. b | 14. b | 19. b | 24. c |
| 5. a | 10. d | 15. b | 20. d | 25. b |

PICTURES

- | | |
|--------------|----------------|
| 1. Kettering | 5. Berliner |
| 2. Watt | 6. Röntgen |
| 3. Howe | 7. Sholes |
| 4. De Forest | 8. Leeuwenhoek |
| | 9. Stephenson |

This One



7JNK-J7Y-YDAY

Home Tests with Phosphorus

(Continued from page 102)

phorus and hydrogen, a liquid at normal temperatures, that is self-igniting; and this impurity is trapped and separated from the phosphine gas by the condenser. Avoid breathing the unburned phosphine and have the room well ventilated during this part of the experiment.

YOU can also use your supply of sodium hypophosphite to prepare an unfamiliar and interesting compound of copper, called copper hydride. Make a solution of copper sulphate of practically any strength, and add to it a solution of sodium hypophosphite—using, say, five grams (a teaspoonful) of the latter chemical in ten cubic centimeters (three teaspoonfuls) of water. There will be no visible reaction. Now add a drop or two of sulphuric acid and warm the mixture. Soon a muddy-colored precipitate of copper hydride will form. It is a compound of copper and hydrogen. Too unstable to be kept for long, it readily decomposes into the metal and the gas, as a pair of simple experiments will show.

Divide the solution and the precipitate into two parts. Continue to heat one portion slowly in the original glass

vessel used for obtaining the precipitate. The copper hydride will decompose with a striking result. When you examine the interior of the vessel you will find it coated with a metallic mirror of shining copper.

That hydrogen gas also is produced when copper hydride decomposes may be demonstrated by heating the other portion of the liquid and precipitate in a test tube, which has been fitted with a one-hole cork and a short outlet tube of glass. Light the gas that escapes from the tubing, and it will burn with the characteristic pale-blue flame of hydrogen. A test tube is used for this hydrogen test because such a small vessel is very quickly purged of air by the escaping gas; thus the risk of igniting an explosive gas-air mixture, which has already been warned against in a preceding experiment, is thereby avoided.

Both of the vessels used in these tests with copper hydride will also be found to contain finely divided copper at the end of the experiment. The clear overlying liquid will sometimes exhibit a violet color, doubtless due to the presence of "colloidal" or suspended particles of copper.

Soil-Testing Kits for the Amateur

(Continued from page 43)

phosphorus up to a level to insure maximum fruit and flower growth in that soil. It is as simple as that.

Even the largest kit is simple to operate. This tiny field laboratory is equipped with glass funnels, filter paper, pipettes, and numbered bottles of reagents with stoppers that are like medicine droppers. The reagents are added, not by cubic centimeters or other scientific measures, but by drops. All one has to do is count the drops.

IN THIS kit, a master solution is made by placing a teaspoonful of earth in a filter paper in one of the glass funnels and pouring a liquid over it. The filtrate caught in a large test tube serves for every test. To make the nitrogen test, the operator uses a clean pipette to transfer a specified amount of the filtrate to a cup in a porcelain plate. Then four drops of the reagent in the bottle marked "1" is added. It is allowed to stand two minutes, then stirred with a glass rod, and the color appears. All that is necessary to arrive at the available nitrate nitrogen in the soil is to compare that color in the solution with the printed color chart that is part of the kit. A blue-black color in the solution indicates 100 or more pounds of nitrate nitrogen in the top seven inches of an acre of soil. A faint trace of blue

indicates as little as two pounds of available nitrate nitrogen in the same volume of topsoil. Tables in the manual give the number of pounds to the acre required by various crops, and it is a simple matter to determine how much nitrate-carrying chemical fertilizer need be added either to the acre or to the 100 square feet of garden soil, to bring that soil up to the proper productive level.

THE availability of chemical nutrients in the soil has a direct relationship to the acidity or alkalinity. Extreme acidity or alkalinity may "lock up" the nutrients. If the soil is alkaline and deficient in nitrogen, and a crop with acid preference is to be grown, ammonium sulphate will add both nitrogen and acidity to the soil. If a crop with alkaline preference is to be placed in the soil, the alkalinity can be retained and only nitrogen added by an application of cyanamide or sodium nitrate. The tests show definitely what should be added in fertilizers to bring a balance between nutrient chemicals and the acid-alkaline reaction. Tables in a handbook give the requirements of almost every common garden, field, and orchard crop, and thus guide the gardener in making up soil deficiencies to give the growing crop the most favorable soil-food balance.

(Continued on page 104)

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Deluxe Model MD, pictured here, with enclosed power head and Ready-Pull Starter. \$62.50 f.o.b. fac.

JOHNSON

Sea-horse OUTBOARD MOTORS

Soil-Testing Kits for the Amateur Gardener

(Continued from page 103)

In every case, the only point at which anything is left to the judgment of the soil testing gardener, is in the matching of colors in the solutions with those on the charts.

Anyone interested in amateur chemistry can make tests with his own equipment. (P.S.M., Aug. '37, p. 70). Further information is contained in the Connecticut Experiment Station bulletin, No. 372. This supplies color charts for every test, and gives a full list of the simple laboratory apparatus needed. The bulletin can be secured at a nominal cost.

Just one or two examples will illustrate how valuable these soil tests may be. Potatoes prefer neutral or slightly acid soil. But if the soil is definitely acid, the scab disease that may ruin a crop will not attack potatoes. Therefore, if a grower can be sure that his soil

tests below the point of acidity at which scab will attack, he has insurance that his crop will be free of scab. Similarly, eggplant and tobacco must be grown in soils that are sufficiently acid to protect them from disease.

THE soil of gardens, fields, greenhouses, and truck patches is a vast empire in which chemical reactions are constantly working. No two fields contain exactly the same nutrient values, and one end of a flower bed may differ in chemical qualities from the other end. Every growing crop has its preference as to soil. What may be food for one is poison to another. Beets, cauliflower, celery, lettuce, onions, and spinach must have a soil that is alkaline. Blueberries, potatoes, rye, strawberries, sweet potatoes, and melons would not grow well in

such soils, but do best in soils that are definitely acid. And each of these has its preferences in the amounts of such plant foods as nitrogen, phosphorus, potash, and manganese.

Thus, the magic of science has opened the way for every grower of plants to unlock the mysteries of his soil. By simple, direct, and positive tests, the gardener of today may know the good qualities of his soils, learn their deficiencies and correct them, and provide the most favorable conditions for the crop he is growing. The little field kits, the pocket and handbag laboratories with their color tests and ease of operation, have opened a door through which anyone may proceed to scientific soil control for growing flowers or crops, insuring better yields and the added pleasure of understanding the secrets of growth.

Industry Stretches the Uses of Rubber

(Continued from page 23)

use for a specific purpose he has in mind.

Just recently, a manufacturer discovered that a type of fly paper made abroad caught more insects than his own product. Investigation disclosed that rubber was an ingredient in the foreign-made paper, although the exact formula was a carefully guarded secret.

But shortly after the problem was presented to an American rubber laboratory, technicians developed a rubber formula that proved just as effective, and aided the manufacturer to devise special machinery for mixing the stickum. Fly paper today lasts several times as long as the best kind available a short time ago, does not dry out, and—most important of all—catches more flies.

NOT only are more insects caught in fly paper, because of rubber, but more animals are caught in traps. A few years ago, a trapper taking stock of his catch, found that for every 100 animals caught in the steel jaws of his traps, fifteen escaped by chewing or twisting off their legs. Moreover, the remaining eighty-five usually had pelts damaged by the crushing jaws. Why not cover the trap jaws with rubber, he thought, and reduce this loss and injury?

But, fellow trappers told him, traps are exposed for long periods to sunlight, oil, rough handling, and

wide temperature variations—all enemies of rubber. Nevertheless, he took his idea to rubber experts and was agreeably surprised to learn that there already existed a rubber compound that would fill the bill.

Specific instances like these, each

one telling the story of the genesis of a new rubber application, indicate the astounding variety of jobs that rubber is called on to perform. Rubber horseshoes muffle the clomp-clomp of the animals' feet as milk wagons trundle over city streets in the early morning

hours. A non-hardening rubber putty is being used to seal glass into metal window sashes, and to fill cracks in ocean-liner decks. Transparent wrapping papers are moisture-proofed by the application of a rubber compound in powdered form. Mattresses and cushions are made to hold their shape indefinitely by bending the hair stuffing into springy forms and then coating them with rubber. Rubber bearings protect underwater propeller shafts from damage by sand and other abrasives.

A COMPLETE tabulation of these new, unusual, or little-known rubber products could go on for many pages without exhausting the list. Yet in Akron, Ohio, the world's rubber center, there is no evidence that the search for new ways of using rubber is slackening. For it is the opinion of veteran scientists that rubber, although now one of the world's leading manufacturing materials, is just coming of age and there is still a great amount of experimental work to be carried on.



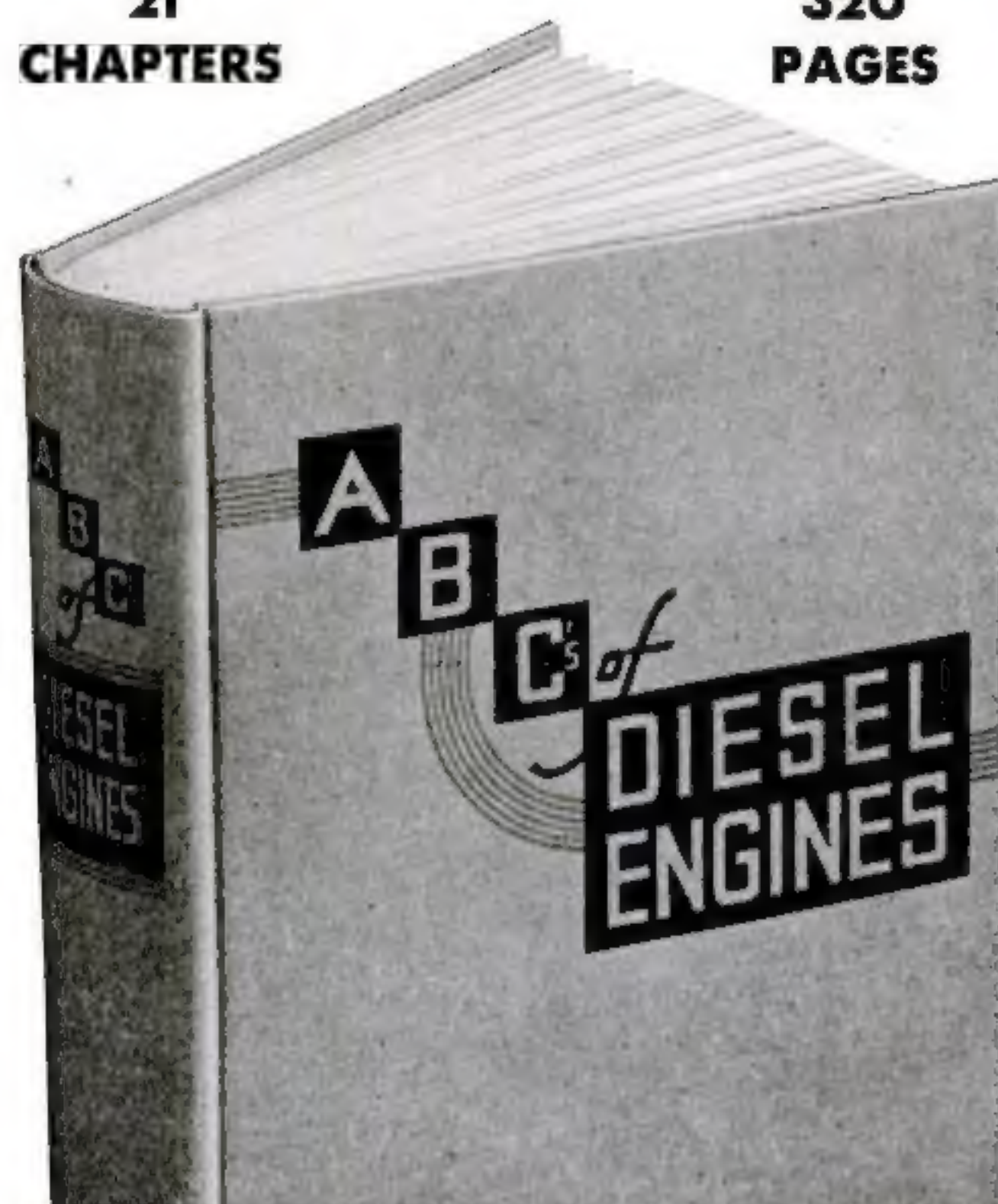
Chairs, sofas, and other pieces of furniture are now "stuffed" with ready-made cushions of spongy rubber. Made in standard sizes and shapes, the pads are attached to the furniture frames and covered with fabric as seen above

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